Engineering News-Record

A Consolidation of Engineering News and Engineering Record
McGRAW-HILL COMPANY, INC.
February 28, 1918

Engineering Library
MAR 2 1918
UNIV. OF MICH.

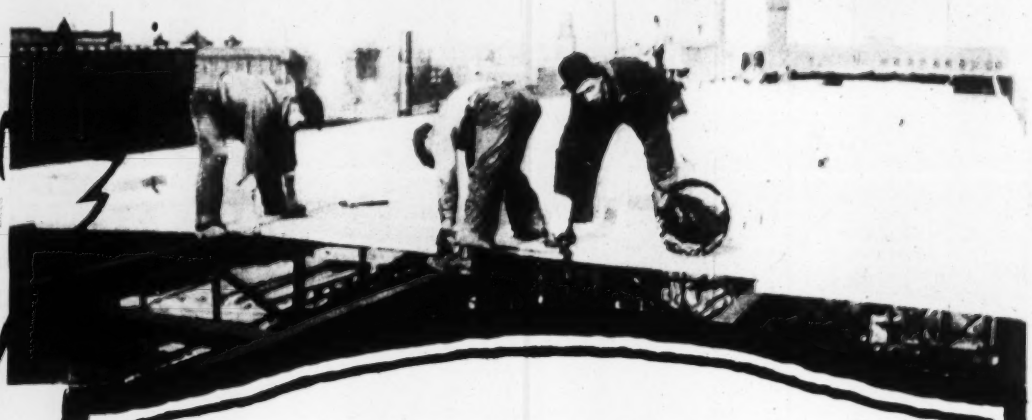
ARTICLES IN THIS ISSUE

Long Viaduct Across Kaw Valley Completes Kansas City Terminal Improvement
By F. W. EPPS

How to Proportion Unsymmetrical Arches
By JOSEPH P. SCHWADA

U. S. Engineers Find French Quarries Operated Mainly by Hand Labor
By ROBERT K. TOMLIN, JR.

FEDERAL CEMENT TILE



Made, Laid, and Guaranteed

Where speed, economy, practicability and durability are essential, there you will invariably find engineers, architects and owners specify the lightest fireproof covering on the market—Federal Cement Tile—in one of its varied forms. This is clearly demonstrated by the fact that during this strenuous period when the above specifications are of such vital importance, the United States Government (as well as hundreds of owners doing war work) relied on Federal Tile to meet the emergency, and it was met.

Today war materials are being produced under not less than twelve million square feet of Federal roofs.

Let Federal Engineers cooperate in the solution of your roof problem. Write for your copy of "THE INDESTRUCTIBLE ROOF." It's filled with facts that will interest you.

Federal Cement Tile are made, laid and guaranteed by

FEDERAL CEMENT TILE COMPANY

920 Westminster Bldg., Chicago, Ill.

"The Indestructible Roof"

A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—James H. McGraw, President

ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. Mehren, Editor — Charles Whiting Baker, Consulting Editor

Volume 80 — NEW YORK, THURSDAY, FEBRUARY 28, 1918 — Number 9

Putting Their Houses in Order

THE employers have begun to set their houses in order. Some employers, not all. Careful study is beginning to replace indifferent handling of the labor problem. Necessity is forcing a modification of the autocratic policy. The worker will no longer be a chattel. He demands to be treated as a human being. His aspirations must be consulted.

There was plenty of reason in the past for the employer changing his attitude. Where he did not have strikes, he found at least indifferent and consequently wasteful labor interest. His dominant thought, though, was to hold all power. He feared that any injection of the milk of human kindness would lead the men to believe that he was weakening, that kindness was the resort of waning strength.

Yet there were plants around him that continued successful even though the men were treated like humans; aye, that increased their profits through greater efficiency and greater labor stability. Gradually the public, learning faster than the owner, forced upon him shorter hours, accident prevention measures, proper sanitation, workmen's compensation. And lo! the industry was the gainer. There was physical response to the improved conditions; and just as surely, response in spirit, even if unconscious.

Still, the absolutism in management remained. The changes were forced, not voluntary.

Then came the war. Labor, from receiving an indifferent interest from the employer, began to get his chief attention. The supply was ostensibly short.

For a decade those who thought deeply on management problems have urged a closer study of the human element. Management inefficiency, as affecting the worker, had been berated. The value of intelligent employment and promotion systems, involving a close study of the aptitude, ability and ambition of each employee, had been emphasized. All to no avail until the war came.

Now the demand for skilled employment managers is far greater than the supply. With an apparent labor shortage the wisdom of putting each man in his best place, of giving him the highest type of work he is capable of doing, of encouraging him to improve himself, has been apparent.

Intelligent employment methods must become universal. They are necessary for the development of the highest efficiency of the individual as an individual and as a member of an industrial organization. Moreover, they bring employee and employer into close, sympathetic touch. Each will profit from the experience of the other.

Such contact, too, is a necessary preparation for the inevitable—cooperative management. Any scheme that is not based on confidence and sympathy will fail. If cooperative management is accepted grudgingly, if an artificial structure of labor participation in plant control is nullified by an unjust employment system, there is sure to be strife. The insincerity will prevent effective cooperative work.

And since cooperative management is to be expected as a war product, it behooves industrial leaders to prepare for the day, to put their houses in order. There must be in each plant someone whose duty is to know the worker, whose seat at the council table is that of the employee's advocate.

Such is the way that progressive employers are preparing for the industrial change that will inevitably follow the war.

Another Weighty Reason for Municipal War Programs

NOW that the Federal Reserve Board's capital issues committee has set $100,000 instead of $250,000 as the minimum for municipal bond issues to be passed on by it, there is more widespread need than ever for municipal war programs along the lines urged by *Engineering News-Record* of Jan. 3, page 6. A city with a well-considered municipal war program will be better able to establish its claims for the necessary character of a proposed loan than one which is taking up each project without regard to its other wants for the next two or three years, and with no thought for the broader needs of the country during its participation in the war.

Important Work for Railway Convention

THIS journal has repeatedly urged that the war is a reason for holding, not postponing, society conventions. That is the view of the board of direction of the American Railway Engineering Association. An announcement issued to the membership states that the program for the convention in Chicago, Mar. 19-21, will take cognizance of the changed conditions in the railway world, and points out the duty of the association and its members to help devise ways and means of solving present problems and bettering conditions. Those unable to attend are invited to send written discussions. Subjects mentioned for consideration include emergency yard improvements to relieve freight congestion, ways and means for meeting material and labor shortages, reclamation and utilization of scrap material, conservation of resources and the discovery of new sources of economy. All are worthy of concerted study. The conventions of the association are always fruitful; next month's should be doubly so.

Burning Coal to Consume Garbage

IN THE face of coal famine, railway paralysis and food shortage for man and beast some American cities have been burning precious coal to incinerate garbage which might have been fed to hogs, conserving animal feed stuff and producing much needed pork—worth $16 to $20 a ton. A specific instance is afforded by Meadville, Penn., which paid out $1500 for coal and about $1000 for labor and other items to burn mixed refuse in 1917. While only 477 tons of coal and an estimated amount of 2659 tons of mixed refuse were consumed the principle involved is the same. In contrast, Minneapolis, Minn., which for some years has been burning coal at a refuse incinerator widely advertised as producing electric current, has recently let a contract under which its garbage will yield it $1.26 a ton. Earlier, Springfield, Ohio, shut down work on an incinerator under construction and turned its garbage over for hogs. Springfield, Mass., and Harrisburg, Penn., have recently shifted their garbage from privately owned reduction works to hogs, also privately owned. For years past many other cities have been sending their garbage to hogs, municipally or privately owned—notably Worcester, Mass., Grand Rapids, Mich., and Denver, Colo. The argument for feeding garbage to hogs is strengthened by the results of the agricultural census of New York State, taken Jan. 1, 1917, which shows a decrease in the number of breeding sows but an excess of supply over demand—"probably because hogs depend largely on food shipped from the corn belt." Burning coal to destroy garbage in the same territory with such conditions is a double crime. Strong as the arguments are for garbage disposal by feeding to hogs, no city should adopt that method without first obtaining competent engineering advice, since there are pitfalls to be avoided in order to ensure sanitary and commercial results and because many local factors have to be considered before a method of garbage disposal is selected.

Is the Screw Spike a Good Rail Fastening?

USE of the screw spike as an improvement in American railway track construction has been advocated for many years, and several leading railways have introduced this type of rail fastening extensively and with encouraging results. In contradiction of these conclusions, engineers of the Pennsylvania railroad system report that on experimental sections of main track the screw spike has proved less reliable and less economical than the common drive spike. An abstract of this report is given on another page.

While the report covers a variety of related subjects, there are a number of aspects of the spike question upon which it does not touch. It does not discuss specifically the relative condition of the wood at the holes of screw spikes and drive spikes. This relative condition, after a period of service, would be influenced by previous crushing, disintegration and decay of the ties. There is an implication, however, that the wood between and outside of the screw threads is damaged by vertical motion of the spike, so that when the spike is once loose it does not help to screw it down.

This same condition occurs with the plain spike, after it has worked loose and been driven down again and again. The report seems to indicate, however, that the damage to wood and loss of grip is quicker with the positive hold of the screw spike than with the skin friction of the drive spike. Whether the damage is done by shear or crushing, whether the boring tool has any unfavorable effect upon the wood around the spike hole or whether the size of hole bored for the screw spike has any relation to the damage of the wood and loss of grip are matters not discussed in the report. Bored holes were not used for the drive spikes, although this treatment has been recommended as a means of improving the grip of such spikes.

Turning of the spikes when screwed into metal expansion sleeves is one trouble noted, and this results in raising the spike head clear of the rail. This is due evidently to the relatively light friction of metal on metal. It should be an easy matter, however, to devise some simple means of locking the spike against rotary movement. Nothing is said regarding the form of thread as a factor, or the possibility of using a wider thread to increase the area of horizontal bearing surface in the wood.

Long and successful use of the screw spike on European railways has been one of the main arguments for adopting the same fastening in this country. This is

supported on the whole by the experience of American railways. On the other hand, it must be admitted that several auxiliary devices to secure the screw spike, as mentioned in the Pennsylvania report, have been invented and used in Europe, and were evidently devised to meet existing conditions. Undoubtedly the heavy loads, and especially the heavy wheel loads of both locomotives and cars, in American railway main-line traffic produce much more severe conditions of service than those existing on most European railways. But as some American railways have found the screw spike satisfactory on a considerable mileage of track under heavy traffic these conditions cannot entirely account for the unsatisfactory experience on the Pennsylvania.

Strong endorsement of the screw-spike fastening was given about two years ago by G. J. Ray, chief engineer of the Delaware, Lackawanna & Western R.R. As the result of five years' experience with some 2,272,000 screw spikes, he considered that they had proved very satisfactory, and were superior to the drive spike both in safety and as a means of reducing injury to the tie. He intimated, however, that a bolt fastening might be still better for heavy-traffic track, and this type of fastening has since been introduced. On this road the screw spikes bear directly on the rail. The Pennsylvania trials included this method and also the use of an intervening clip, but which method is the better is left open to question.

This recent unfavorable report is the latest word on the subject and carries weight from the extent of the trial and the personality of the men in charge. But it is not the last word, and does not refute the favorable conclusions of Mr. Ray and others, based on extensive experience under service conditions. The results obtained on the Pennsylvania will not be accepted generally as classifying the drive spike as the superior type of fastening. Some discussion of the report may be expected, and will be looked for with interest.

British Labor Platform Significant to Engineers

THERE is food for thought and a spur to action for the American engineer in the proposed radical reconstruction program of the British Labor party, which the *New Republic* characterizes as "probably the most mature and carefully considered program ever put forth by a responsible political party."

Boldly recognizing that the present system of ownership of the means of production by individuals responsible only for the making of profits, and responsible for even that only to themselves, has led business astray from the paths of efficient production to those of manipulation and speculative profits, the document proposes such extreme remedies as public ownership, with public management implied, of the means of production, and the control of all surplus wealth by society. These things are being seriously considered in England, and with good reason. It is admitted that the party which proposes them will at the least hold the balance of power after the next election. Whether any such extreme methods must be seriously considered here depends on the speed with which we can swing production from the speculative basis to which the workers rightly object to the engineering and scientific basis which this document shows to be the British Labor party's ultimate and justifiable object; and on quickly spreading the realization that in the new order labor must have a more responsible part, a larger and more intelligent share in the conduct of industry.

This document, socialistic in some of the methods it proposes, nevertheless defines many objects of labor which can be reached, not through mistaken ultra-radical measures, but only by coöperation with the other elements of society. If this coöperation is not forthcoming, there is no denying the fact that labor here, as well as in England, has the power and the will to force a disastrous succession of socialistic extremes.

On the engineer, who will be concerned with the scientific planning of industrial development as never before, must fall the larger share of this responsibility.

Hog Island

UNKNOWN two months ago, today Hog Island occupies, unfortunately, the center of the war stage. It has been the target of investigation which has produced an impression in the minds of the people that there has been there a riot of extravagance.

The contractor, who acts as the Government's agent, is soundly berated. The facts that he was under the orders of the Shipping Board's Emergency Fleet Corporation, that the plant and organization which he put on the job were approved by this corporation, that all expenditures were subjected to its visé, that aside from delays caused by the weather those of chief moment were due to the failure of the fleet corporation to deliver piles, and finally that despite all the hullabaloo the prospective delivery of ships on contract time has not been interfered with—all these seem to be forgotten. Fair mindedness has been put in the background. Sensationalism would be satisfied.

The chief charge is extravagance—men loafing on the job. To repeat what was said editorially last week, the work was done in the severest winter officially recorded on the Atlantic Coast, while pile deliveries, for which the Government, not the contractor, was responsible, were bad. The plant had been assembled, the gangs recruited. They had to be held. It was costly, but there was no remedy. And the Government knew that the plant and men were there, had in fact the right to order them off if it wished.

Moreover, the contractors did not profit through dragging out the work. The principal contract provides no fee on the yard construction; the subcontractors receive fixed fees, not a percentage on cost.

On the matter of efficiency no word is necessary for intelligent men. Who could, even in the most favorable times, put an organization of 25,000 men together in six months without efficiency? How much more difficult the task in the present state of the labor market! Is the War Department above criticism, or the Shipping Board?

As a matter of fact wonderful things have been done on Hog Island. In the face of extraordinary difficulties, of labor and material shortage, and of weather, a score of ways are fast nearing completion (the keel is being laid on one), shops and power plants are going up rapidly, extensive water and sewage systems have been

installed, 36 miles of railroad track have been laid—and withal there is a snap and a spirit about the work that gives to the experienced eye assurance that the job is well in hand and will be driven to successful completion. It is unfortunate that idle talk has allowed any other impression to get out to the country. Here is a yard that in 22 months is to complete 991,000 tons of shipping, though the maximum production of the whole country previously has been only 400,000 in a year. What was being done should have been told the public at frequent intervals. If anything was wrong it should have been exposed and corrected. In so far as can be done without giving aid and comfort to the enemy, the work should receive full publicity. The country will be heartened if the work goes well. It should have the information to bring those responsible to time if failure threatens.

At present the outlook is excellent. Hog Island deserves the country's confidence—not its condemnation.

Preliminary Work on Great Federal Irrigation Program Needed Now

FOR several years the U. S. Reclamation Service, which has been engaged since 1902 in the construction of irrigation works in the arid states of the West, has been slowing up its operations. The policy of the Administration has been to complete the projects already undertaken as fast as funds became available from the sale of public lands and from other sources, but to undertake no new projects. This procedure has been justified on the ground that a considerable part of the land which has been reclaimed in these Federal projects is not yet utilized for agriculture. The delay in getting these lands under cultivation is one reason why the funds available for reclamation work have not been restored through payments by settlers on the reclaimed lands as rapidly as was expected when the law was originally enacted. In addition, the pressure exerted from one source or another upon this and previous Administrations to give settlers a longer time in which to make payments has further operated to delay the restoration of the Reclamation Fund.

Under these conditions it has been urged that the Federal Government ought not to invest additional money in large amounts in irrigation works until the lands already reclaimed were taken up by settlers and until it became evident that the Federal investment in land reclamation would eventually prove profitable.

The revolutionary change in conditions resulting from the war has recently brought about a reconsideration of this policy. It has come to be realized that the world is facing a food scarcity which is not a mere temporary condition, but which, as far as can now be seen, is likely to persist for several years before the normal accumulated store of food supplies can be restored. This means, of course, a continuation of high prices for crops of all sorts and an urgent demand for farm lands for settlement. This condition is certain to be accentuated when peace is declared and millions of men are suddenly released from army service and have again to find homes and occupations. If we would forestall serious trouble when this great influx comes in the labor market, we should begin to make provision now whereby these men can find employment in productive industry as soon as they are mustered out of Government service.

It is with a vision of these conditions that plans are now being worked out at Washington for the resumption of Federal irrigation work on a large scale. Opportunities for such work are well known to engineers. Take for a single example the great Imperial Valley in southern California and Arizona, where 275,000 acres are now irrigated with water taken from the Colorado River. Every year the demands on the low-water flow of this stream have increased; and last season there was at times not enough water to supply all the irrigators. The lands on the Mexican side of the border were taken care of, but many irrigators in United States territory suffered heavy losses, because just when water was most needed for their crops the level in the canals was too low to supply them.

Government engineers have already made preliminary investigations for the creation of enormous storage reservoirs on the headwaters of the Colorado. The run-off resulting from the melting snows on the mountains and the spring rains, which ordinarily produces disastrous floods in the lower reaches of the river, can be stored in these reservoirs to increase enormously the area in the Colorado delta which can be made fertile.

This is but one example of many that might be cited illustrating the need and the opportunity for a great extension of Federal irrigation work. Obviously, the necessary funds can not be provided from the present limited income from sales of public lands, but must be met from the National treasury.

Doubtless with the present compelling need for funds for the prosecution of the war, no large sum can be spared to finance any works of internal improvement. On the other hand, such works as are here referred to will take years to construct. Before any large amount of money can be expended it will be necessary to devote time to preparatory work in surveying, planning and deciding upon the comparative merits of various projects. In order that thorough studies of this sort may be made, this work should be undertaken without delay. As stated at the outset, moreover, preparation ought to be made now for the inevitable great influx of labor when peace comes; and it will be vastly better to employ these discharged soldiers on well-planned internal improvements than to attempt makeshift work, as has so often been necessary to cope with conditions of unemployment.

It should not be overlooked in this connection that where flood waters are stored for irrigation it will be possible on many projects to develop also a large amount of water power. This has in fact already been done on a number of existing reclamation projects. At the Roosevelt dam on the Salt River in Arizona water power is being generated the earnings from which are sufficient to pay the cost of the whole work, so that the many millions of dollars of increased land values resulting from the reclamation is clear profit. Both Congress and executive officials are thoroughly in earnest in their desire to have water-power development undertaken on a large scale. The opportunity is open here to begin this work by direct Government action in connection with the reclamation of arid lands.

High-Line Viaduct and Bridge Improve Rail Entrance to Kansas City

New Route Remedies Delays on Approach Tracks on West Bank of Kansas River, Which Crossed Streets and Yards at Grade—Viaduct Has Concrete Slab Deck—Bridges Have Special Shallow Floor

By F. W. Epps

Former Assistant Office Engineer, Kansas City Terminal Ry., Kansas City, Mo.

THE Kansas City Terminal Ry. is on the eve of completing the last feature of its general plan to give Kansas City adequate passenger facilities. The High Line with its long steel viaduct and its double-deck bridge over the Kansas River will soon be open to traffic.

The High Line is about 3½ miles long and consists of 8800 ft. of filled approach, 7600 ft. of steel viaduct supporting a concrete deck, and a 740-ft. truss bridge with creosoted-wood deck, across the Kansas River. The shape of the whole is that of a huge curved Y with the stem pointing toward the Union Station and the two arms, designated respectively the Missouri Pacific connection and the Union Pacific connection, extending out to the north and the west.

When the Kansas City Terminal Railway Co. built its new $6,000,000 Union Station and abandoned the old structure, the provision contemplated by the plans for efficient handling of traffic had been carried out for all lines except the Rock Island, the Union Pacific, the Missouri Pacific from the northwest, and the Chicago Great Western, all of which come in through Kansas City, Kan. The first two, coming from the west over the Union Pacific tracks, are carried in over a track which is in constant use for industrial switching from three big packing houses and numerous smaller industries, and then cross the river on a single-track bridge which is carrying an average of 180 train movements per day; they traverse a busy yard and cross at grade fifteen other tracks and four important streets in Kansas City, Kan. The last two roads come in from the north over the bridge of the Chicago Great Western, located near the mouth of the Kansas River. This single-track bridge is used very extensively for main-line freight and also serves switch movements from numerous mills and factories on the north bank of the river; the trains are then carried through the Chicago Great Western yards and down a narrow street in the wholesale district, where four streets are crossed at grade, then on the main freight tracks of the Kansas City Terminal, which pass yards of four other roads before arriving at the Union Station.

In order to separate the passenger traffic from the freight traffic on these four lines and to carry the passenger trains directly into the Union Station with the least possible delay, an overhead structure was planned. Construction upon this was deferred several years pending completion of franchise negotiations with Kansas City, Kan. Orders to proceed with the work were issued Apr. 1, 1916.

The bridge department of the terminal company was then reorganized, and preliminary plans and estimates which had been made by the old organization were brought up to date. The general contract for the entire High Line was let on Oct. 13, 1916. By the first of January, 1917, details for the river crossing had been completed, orders for 17,000 tons of steel had been placed at the mills, the work of detailing had been begun, and by June 26, 1917, all the detail drawings were in the shop.

The filled approaches, as well as the concrete sub-

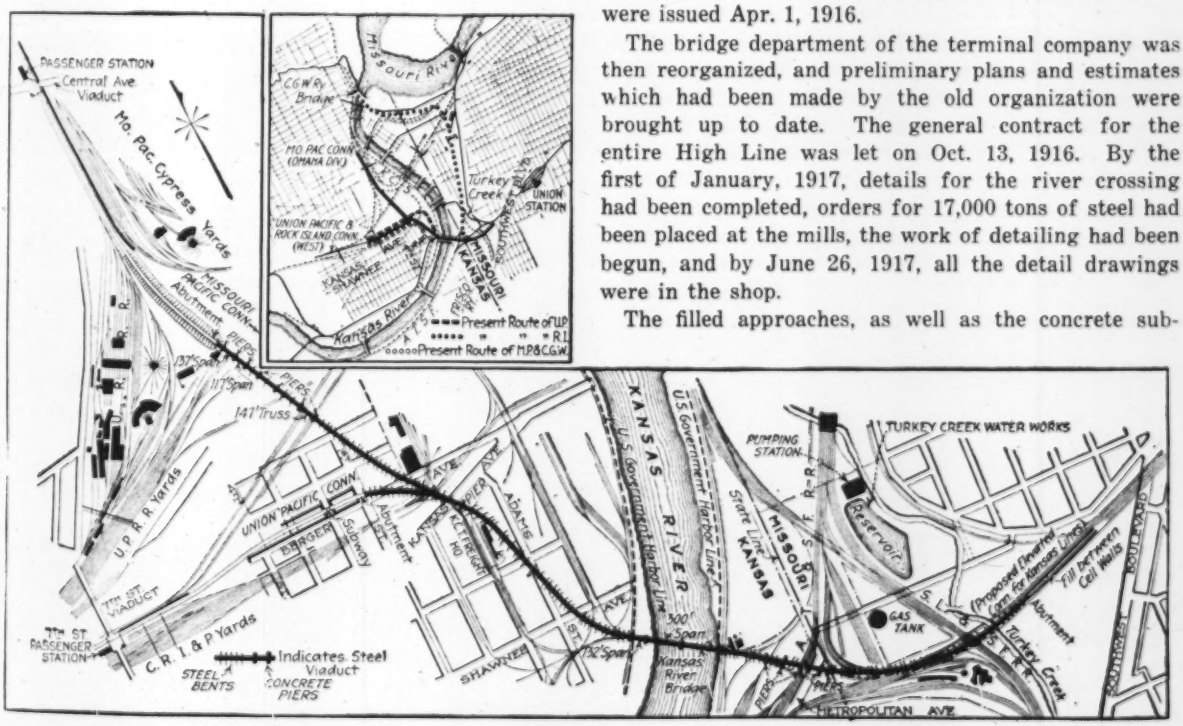


FIG. 1. MAP OF KANSAS CITY HIGH LINE, A ROUTE GIVING DIRECT OVERGRADE ENTRANCE FROM WEST SIDE OF KANSAS RIVER

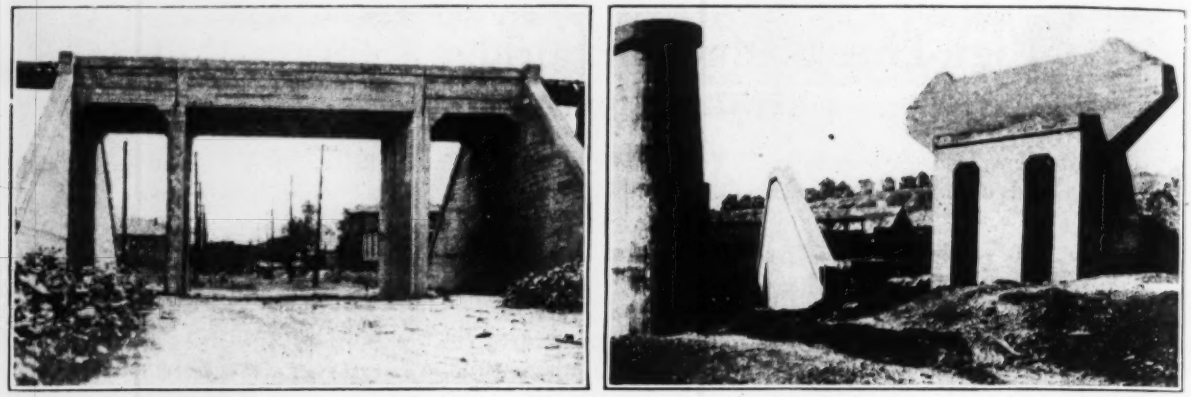


FIG. 3. CONCRETE STRUCTURES OF VIADUCT APPROACHES

structures of the viaduct and bridge, were taken in hand as soon as the work was put under contract. Structures of special interest contained in them are shown by views and drawings in Figs. 2 and 3.

The filled approaches—one at the stem and one at each arm of the Y—are of two kinds, those with standard walls and those of cellular construction.

The cellular structure, shown in Fig. 3, is used on the east approach where four main-line tracks running from the station were changed so that the two center tracks rise to the viaduct level. The retaining walls of these tracks are only 30 ft. apart, and it was found to be more economical to put in ties between them to carry the horizontal thrust than to use thick walls independently capable of resisting overturning. This tied cell construction was used for heights above 10 ft.; under that height two standard walls were used, without connections.

The concrete ties are placed at intervals of 14 and 16 ft. They were designed to act as a support for a construction track carrying dirt trains for the fill between walls.

The standard wall, also, shown in Fig. 3, is of broken-back type, and is carried on a base whose width is five-eighths of the total height of the wall. This type of wall has been used extensively by the Kansas City Terminal. On the High Line it was used on the west and north approaches, wherever the fill had to be kept from enroaching on streets or private property.

The open fills in the north and west approaches were made of yellow clay. Their slopes were planted in alfalfa. The finished roadbed is to have a crown width of 33 ft., with side slopes $1\frac{1}{2}$:1, but the fresh fill was made 42 ft. wide to allow ample margin for shrinkage.

Where the Union Pacific connection crosses Second St. the fill is interrupted by a subway of unusual type. Each sidewalk of Second St. is separated from the roadway by a 30-in. wall which, with the 42-in. back-

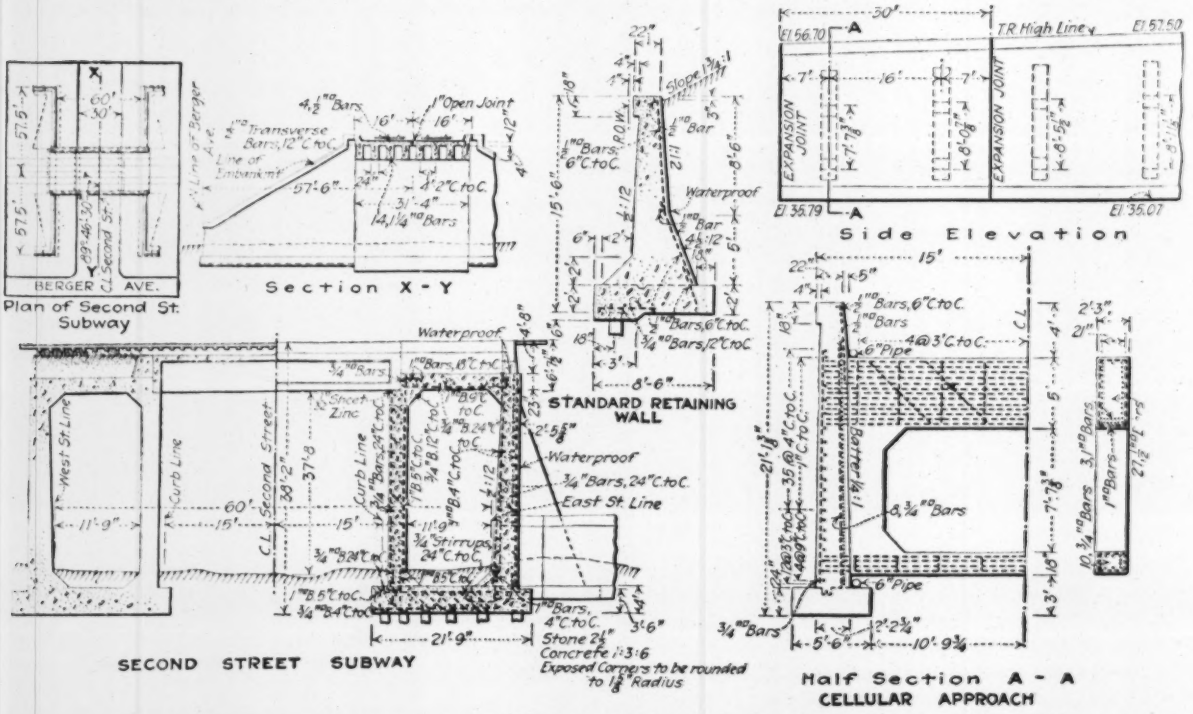


FIG. 2. SECOND STREET SUBWAY AND WING ABUTMENT WITH SUPPLEMENTARY TOE WALL

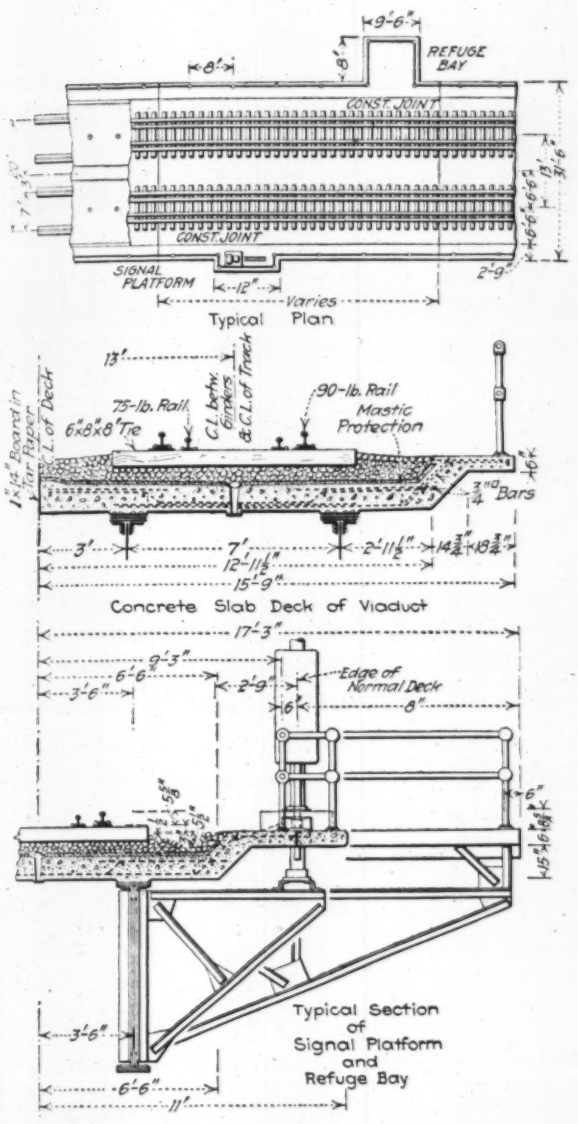


FIG. 4. DECK OF VIADUCT IS A REINFORCED SLAB CARRYING BALLASTED TRACK

wall, the 48-in. base and the 24-in. top, forms a monolithic structure which is called a box abutment (see view in Fig. 2); this box is reinforced against distortion as a whole, and the backwall and top are designed as beams to carry the earth pressure and train loads (Fig. 3). Between these two abutments the deck is in halves separated by a longitudinal joint, so that they will act independently when one or the other is loaded. Each part is monolithic and is made up of four T-beams.

This style of street crossing was used after careful comparison with the usual type (abutments and piers carrying simple spans of concrete or structural steel), which showed quite a saving in cost, due to the large bearing area of the box abutments compared with their yardage.

Two of the three abutments (where viaduct joins earth fill) are of the ordinary buttressed form, but the third, on the Missouri Pacific connection, consists of an open pier with backwalls cantilevered out on each side to form wings which keep the fill away from the bridge seat. The fill flows around the wings and through the opening in the pier base of the abutment and extends so far that its outer end is cut off by a low retaining wall of gravity type, to keep the fill on terminal property.

This abutment construction was developed because ample space was available at the sides and in front of the structure, a condition not present at the other ends of the viaduct.

The substructure of the viaduct consists in general of low concrete pedestals for the columns. In some locations the pedestals and the steel bent resting on them are replaced by a concrete pier high enough to carry the longitudinal girders of the viaduct. This arrangement was adopted wherever longitudinal tower bracing of the viaduct could not readily be provided for. Piers were also used under the truss spans over the Union Pacific R.R. yards.

In the subsoil no rock was encountered except a layer of boulders about 70 ft. below ground level. The column footings and piers were therefore founded on creosoted piles 25 to 30 ft. long, figured to carry from 20 to 25 tons each. The bearing power of the piles was checked up by the driving resistance and if necessary the number was increased while the foundation was being put in.

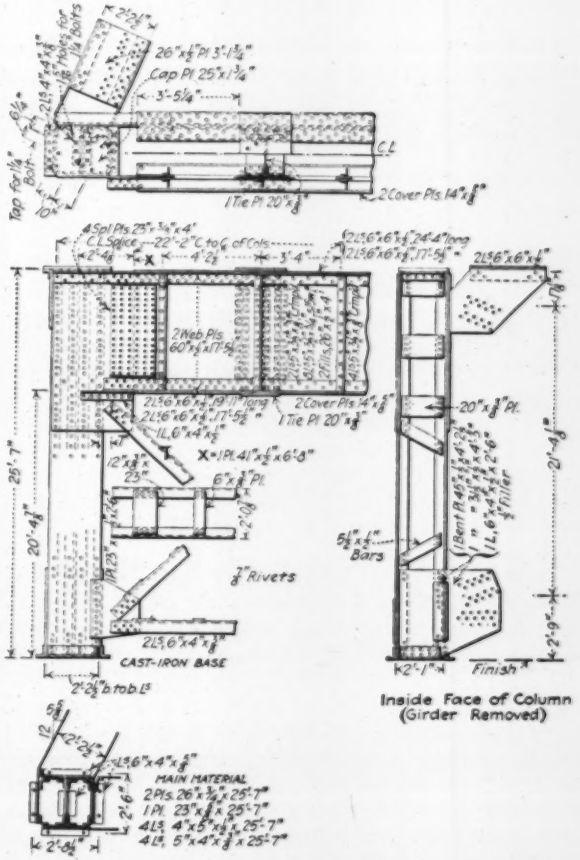


FIG. 5. BENTS OF VIADUCT DESIGNED WITH SPECIAL ATTENTION TO SIMPLICITY AND EASE OF ERECTION

In concreting the column pedestals the anchor bolts and the plates at their lower ends were set in the forms, and in order to allow for adjustment of the column bases to true position 3-in. galvanized-iron pipe was placed around each anchor bolt, thus coring out a pocket around the bolt to permit true placing of the steelwork. After the bases were set the pipes were filled with grout.

The pedestals were all finished ¼ in. high. They were bush-hammered to proper elevation and surface at the time of setting the steel, and the bases were then grouted in place.

The steel viaduct consists generally of transverse bents comprising two columns and a cross-girder, carrying four lines of longitudinal girders supporting the concrete slab deck on their upper flanges. The railway track is laid on ballast on the slab.

The design was made for the following loads: Train load, Cooper's E60 on both tracks, with impact taken as three-quarters of 300 (300 + L); braking load, 20% of the uniform train load of 6000 lb. per lin. ft. on one track, between expansion points; wind load, 50 lb. per sq.ft. on the unloaded structure, or 30 lb per sq.ft. plus 400 lb. per lin.ft. on the loaded structure. The centrifugal load on the transverse bents figured about 70% of the wind load for the sharpest curve, 6°, and about 30% for the other curves. As maximum wind and centrifugal effect are not likely to occur at the same time, only the larger force (wind) was considered in the design, the centrifugal load thus being ignored. Temperature stresses also were ignored.

As soon as the determining points of the structure had been established, calculation diagrams were made up giving the center lines of girders and bracing and lengths of all pieces, and locating all working points. These diagrams after being carefully checked served as basis for the detailing.

The columns of the viaduct were designed of H-shaped cross-section built up of plates and angles: Eight angles 5 x 4 in. ordinarily, and on the largest column 6 x 4 in., connected by a web and two cover plates. They are carried on cast-iron bases, which distribute the load so as to reduce the bearing on the concrete pedestals to 600 lb. per sq.in. Only four sizes of bases were used.

In the design of the columns, allowance was made for eccentric loading from trains on only one of the adjoining spans, bending due to wind pressure on bents having no sway bracing, and deflection of cross-girders. The loads were determined according to definite outlines and computation formulas which had been previously worked out and tabulated. A series of cross-sections varying by intervals of about 4 sq.in. in area was made up, and all columns were selected from this list.

For simplicity in making connections constant horizontal dimensions were maintained: Distance out to out of cover plates, 25 in., and width back to back of side angles, 26½ in.

The heaviest column weighs 15½ tons and has a sectional area of 186.5 sq.in.

The cross-girders are double girders made up generally of two 60-in. webs spaced 25½ in. inside to inside, and eight 6 x 6-in. flange angles. This construction was chosen because it makes a stiffer bent, provides a much larger and better seat for the longitudinal girders, and gives much better connections to the columns than the use of single-web plate girders; the latter, moreover, would have required a prohibitive web thickness in many instances.

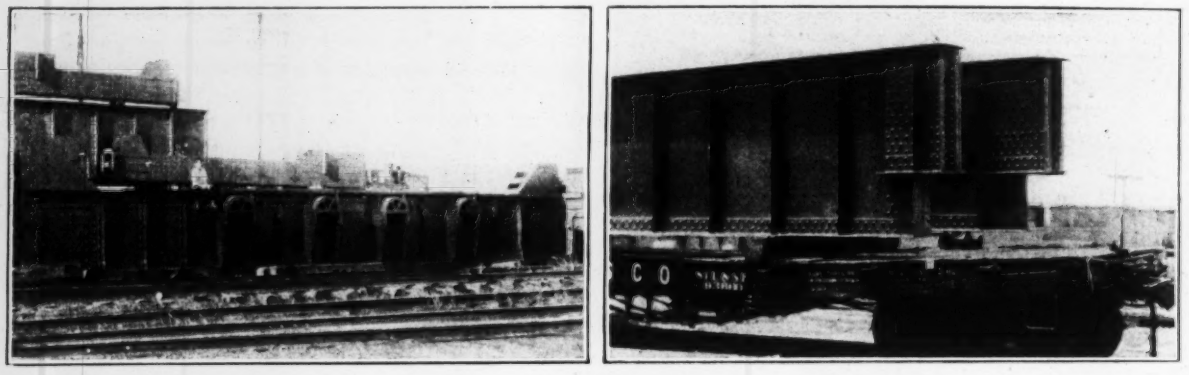


FIG. 6. STRINGER POCKETS USED WHERE CLEARANCE WAS LOW—AT RIGHT, STRINGER NOTCHED FOR SEATING ON CROSS-GIRDER

The designing in this part of the work could not be systematized as readily as in the other parts, on account of the fact that the standard distance of 20 ft. center to center of columns had to be varied in a great many cases to suit the tracks and streets on the ground. However, this did not prevent the following of a definite outline in the design, which made the results consistent and simplified the work, and a chart was made up for girders falling into a certain standard class. In general, the cross-girders are field-riveted to large gusset plates which are shop-riveted on each side of the columns and form a butt splice with the web plates of the cross-girders.

The other method of connection that could have been used here is to run the webs of the cross-girders out and connect them directly to the faces of the columns. Layouts of the two schemes showed that the latter method made the erection much more difficult and gave little room for riveting. The plan used also permits the columns to be shop riveted at the top.

Most of the longitudinal girders rest on 1¾-in. steel slabs on the top flanges of the cross-girders, but in

FIG. 7. HIGH-LINE VIADUCT DURING ERECTION

certain cases, where the cross-girder is raised for clearance, the longitudinal girders rest in stirrups with semicircular cast-iron bearings. The largest cross-girder is 46 ft. long and weighs 41 tons.

The longitudinal girders are in pairs, 13 ft. c. to c. of pairs (the same distance as the track spacing); in each pairing the spacing is 7 ft. The two systems of laterals were placed low enough to support the forms for the concrete deck. The girders are made up generally of 78-in. web plates with 6 x 6-in. or 8 x 8-in. flange angles and 14-in. or 18-in. cover plates. The constant depth was used in order to make the details standard throughout the job.

In designing the longitudinal girders a chart was first made up giving the sections for different girders, and this was used to make up a table of component parts of girders for given spans. With this table the detailer could pick out his sections and lengths of cover plates as soon as the girder was assigned to him. Sheets of standard details were made and these were followed in detailing all the steelwork whenever possible.

Where tracks pass under the viaduct the steelwork is to be protected by 3 in. of gunite shot on over a reinforcement of ½-in. bars and mesh. Elsewhere the metal is sheltered from the weather by the waterproofed deck of the viaduct.

The deck consists of a 10½-in. concrete slab reinforced with ¾-in. bars 6 in. on centers. It was poured in place, the forms being made in sections which were stripped and sent forward to be used again. Transverse expansion joints were made about 100 ft. apart. A longitudinal joint was formed along the center of the structure to take care of unequal loading on the two tracks. The sides of the deck are cantilevered out to form sidewalks for the trainmen and it is proposed to guard these by a two-pipe handrail. One pipe of the handrail will be utilized as a conduit for the air which operates electropneumatic signals and switches.

The top flanges of the longitudinal girders are protected by a coat of pure coal-tar paint and a covering of sheet lead weighing 2 lb. per sq.ft. (this weight being necessary to allow the sheet to be hammered down over the rivet heads without rupture), which acts as a protection to the steel against rusting from condensation that occurs in spite of the waterproofing of the upper surface of the deck. The waterproofing is of the membrane type and is made up of a primer, one coat of hot asphalt, two layers or 14-oz. asphalt-saturated felt, one coat of asphalt, one layer of cotton drill, one coat of asphalt, two layers of felt, and one coat of asphalt, later covered with 1 in. of mastic. The surface is pitched to drain into 2-in. holes provided in the deck.

Refuge bays 8 x 9½ ft. are provided about 400 ft. apart on alternate sides of the viaduct; these bays are large enough to accommodate a handcar and crew. Brackets are also provided at several points for signal masts, which are located entirely outside the viaduct.

The question of open deck versus ballasted deck was considered, with careful investigation of different designs. Estimates showed that the interest at 5% on the difference in first cost between the open deck and the ballasted deck is about one-fourth of the difference between the yearly maintenance on these two types. There are other advantages in the ballasted deck which made it the more desirable, such as the smoother running of passenger trains and the elimination of a large part of the noise of rapidly moving trains.

Where the Missouri Pacific connection is carried over the yards of the Union Pacific there occur three truss spans 117 to 147 ft. long, for one of which an extra shallow floor of special type had to be designed. The trusses are 35 ft. deep and are spaced 30 ft. 9 in. apart. The first two spans have an ordinary floorbeam-and-stringer floor supporting the creosoted-wood deck. The third, however, crossing the main-line freight tracks and being on a descending grade, had only 3 ft. 1¼ in. depth available from under clearance to top of rail, and special design had to be resorted to in order to accommodate a floor in this depth.

The trusses are raised and the floor system is carried by running girders 4 ft. 6½ in. deep, which hang directly below the trusses on diaphragms at the panel points. The floor is made up of 24-in. cross-girders spaced 5 ft. 5 in. which support four 15-in. I-beams under each track, carrying the creosoted deck for the ballast and track.

The Kansas River crossing is a 5300-ton double-deck bridge with two tracks on each deck, or four tracks in all. It comprises two 300-ft. Pratt trusses with subdivided panels and one 132-ft. span of similar type. One of the special features of the bridge is an extremely shallow floor system in the lower deck, differing quite markedly from that described above. Even more noteworthy is the erection procedure, the bridge being erected around the existing bridge. Various elements of the design were dictated by this method. A subsequent article will deal more fully with this bridge.

One very interesting part of the job was the organization of the bridge department, which was carefully thought out about a year before the contract was let.

The chief inspector, the chief of field parties, and the chief draftsman were given ample time to plan the details of their work. After the contract was let it was found necessary to have all the steel ordered by Jan. 1, 1917, and to follow up with a detailing schedule of about 2000 tons per month. This schedule was carried out by careful, systematic work in the office and drafting room. As the girders were almost all of the same depth, the designing was done by a chart. The designing of the symmetrically loaded cross-girders was also done by means of a chart. The columns, being generally of constant dimensions, were designed by means of a table. The calculation diagrams previously mentioned and tables of elevations of column bases and tops gave the detailers an accurate basis for their work. Representatives of the bridge company were sent down to look over the drawings as they came from the squads, and then prints were sent to the shop, thus avoiding any delay due to drawings not conforming to shop practice.

The High Line Viaduct was designed and detailed and the construction supervised by the Bridge Department of the Kansas City Terminal Railway Co., J. V. Hanna, chief engineer; G. E. Tebbetts, bridge engineer, and A. R. Eitzen, office engineer. The general contractor for the entire job was the Arkansas Bridge Co., of Kansas City, Mo., W. D. Pratt, president. The subcontractors were: For the pile driving, the McMurray Contracting Co., of Kansas City, Mo.; for the concrete work, including the deck, D. Munro, of Kansas City, Mo.; for the fabrication of the steel, the American Bridge Co., Chicago; for the erection of the steel, the Kelly-Atkinson Construction Co., of Chicago; for the wood deck on the truss spans, the Kettle River Construction Co., of Minneapolis; and for the waterproofing of the deck, A. J. Shirk Roofing Co., Kansas City, Mo.

Commission-Manager Form of City Government Does Not Eliminate Politics

Experience of Engineer-Manager at Cadillac, Mich., Indicates That While Plan May Cut Out Party Politics It Will Not Prevent General Apathy and Petty Political Methods—Commission Candidates Should Declare Policies

By T. V. Stephens
Late City Manager, Cadillac, Michigan

FOUR years of commission-manager government at Cadillac have thrown some light on the question, Does this plan eliminate politics? Cadillac answers no. Furthermore, its experience shows that the elimination of partisan politics and the substitution of businesslike government may be followed by general apathy on the part of the electorate with a consequent deterioration on the part of the commission.

Cadillac adopted the commission-manager form of government in 1913 with a vote of 621 for and 518 against, a majority of only 103 votes. The legislative body consists of four commissioners nominated by wards but elected at large, and a mayor who is nominated and elected at large. Two commissioners are elected every two years for a period of four years and at the same time a mayor is elected for a period of two years. The commission appoints the city manager, who need not be a resident of the city at the time of appointment.

In March, 1914, O. E. Carr, then connected with the engineering department of Cincinnati, was appointed as the first city manager of Cadillac. He served successfully and efficiently for two years under a commission which, as a body, desired the government to be placed on an efficient and moral basis. The writer came to Cadillac from Cincinnati, Ohio, and served under Mr. Carr as city engineer and deputy general manager. The opposition, which is and has been very much in the minority, established several petty complaints and even indulged in political prevaricating concoctions. After an atmosphere of uncertainty existing for about six months, a petition for the recall of all of the commissioners was filled, several hundred names being attached thereto. The recall was lost by a vote of 1062 against to 463 for, a majority of 599 in favor of the continuation in office of all officials. The number of votes cast for the recall scarcely equalled the number of legal voters who signed the petition. The vote was clear evidence that the form of government and its management were favored by the great majority. In December, 1915, Mr. Carr resigned to accept the managership of Niagara Falls, New York.

New Commissioners Pledged to "Home Man" Idea

On Jan. 1, 1916, a new mayor and one new commissioner succeeded the two outgoing members whose terms of office had expired by virtue of the schedule incorporated in the city charter. The first real authoritative opposition now hampered the government from the inside, and the first "dose of poison" was at this time administered to the form of government and to the high purposes for which it was adopted and previously conducted. The new officers were elected on promises, known only to a few of their supporters, to elect a "home man" for city manager and to see that the chief of police, who was a Sunday school superintendent and an untiring and efficient worker for the moral uplift of the community, was at once removed. For this purpose the controllers of election depended upon the vote of one of the three previously elected commissioners. His vote, however, was not forthcoming. He stood firmly with the old commissioners and for what they represented and the labor of the opposition at election time was lost. The chief of police was retained in his office for more than a year, at the end of which time he resigned to enter another field of business. The writer, who was still considered an "outsider" after serving two years as city engineer, was appointed city manager by a

four to one vote. The manager succeeded in dropping into the "political cup" of the mayor the necessary amount of "antidote" to neutralize the aforementioned "poison." This, together with the strong influence of public opinion, brought about his undivided support and everything went smoothly and satisfactorily for the following two years. The case against the other commissioner had long been given up as hopeless. The reappointment of the writer as manager by the same commission in January, 1917, with a 60% increase in salary, was accomplished by the same four to one vote.

Interest in Municipal Government Declined

With the elimination of partisan politics following the adoption of the charter, the election issues in 1913 and 1915 became pronouncedly "wet" and "dry," and the "drys" were overwhelmingly successful. Since the vote of November, 1916, which placed Michigan under statewide prohibition after May 1, 1918, little has been said relative to government and elections. The government ran very smoothly and satisfactorily—in fact too much so, as is now realized after the last election. The resultant issues of immorality and inefficiency vs. morality and efficiency were apparently lost sight of for the time being to the progressive element of the city. The "gumshoe" methods of the opposition previous to the election worked hand in hand with the "peace and quiet" of municipal affairs. The last election took place on Nov. 6, 1917. About one-fourth of the voters cast ballots, and the fruitful results of the opposition were realized only after the unprogressive members were well established in office. Secret meetings were called by the mayor where the slate was arranged, which action is significant of the poor representation of the people in general and entirely foreign to honest government.

One Commissioner Opposed to Manager Plan

The mayor, who held the same office during the first two years of commission-manager government and who stood at that time for sound principles, the basis on which the charter was adopted, was reëlected with no opponent on the ticket. Never doubting his continued sincerity of purpose to carry out the full intent of the charter, his supporters took everything for granted and were disgustingly astonished when it was learned that the principles of good representative government were being abused. The voters, further, through their apparent lack of interest in city affairs allowed other typical "absurdities" to gain control of the legislative power of a previously up-to-date and progressive little city.

One member of the present commission is and always has been flatly opposed to the commission-manager form of government, yet this fact was not generally known to the electors previous to his election. He now represents one-fifth of the legislative power of the city. Another member is of the type which declares that methods used in the woods thirty years ago are applicable today and are good enough for the modern city. A fourth member asserts that the reason he voted as he did was that "the Christian Workers' League worked against him when he was running for an office on the 'wet' ticket and that he was going to get even with them now." Can you picture yourself associated with such "representatives of the people"? The fifth one, a member of the old commission, stands alone on all actions taken and undoubtedly will resign in favor of one whose principles parallel those of the majority.

Listless Attitude of Majority

The government is now working under the most deplorable political conditions ever existing in the city. The people are "up in arms" and were it not for the charter provisions stipulating that the commissioners hold office for a period of six months before a recall petition can be filed there would be an efficient and progressive government reëstablished within a period of thirty days.

This condition of affairs is not a fault of the form of government or the manner in which it has been conducted in the past. Neither is it the desire of the majority of the people of the city, but due merely to the listless attitude taken by the progressive element of the city. Things have run too smoothly and satisfactorily to maintain the fighting spirit necessary to hold the offensive position in good government. The city manager under such a legislative body becomes merely the tool of corrupt, inefficient and immoral politics and ample justification is evident for the search of another field of employment by any manager or other employee who desires his efforts to harmonize with progressiveness.

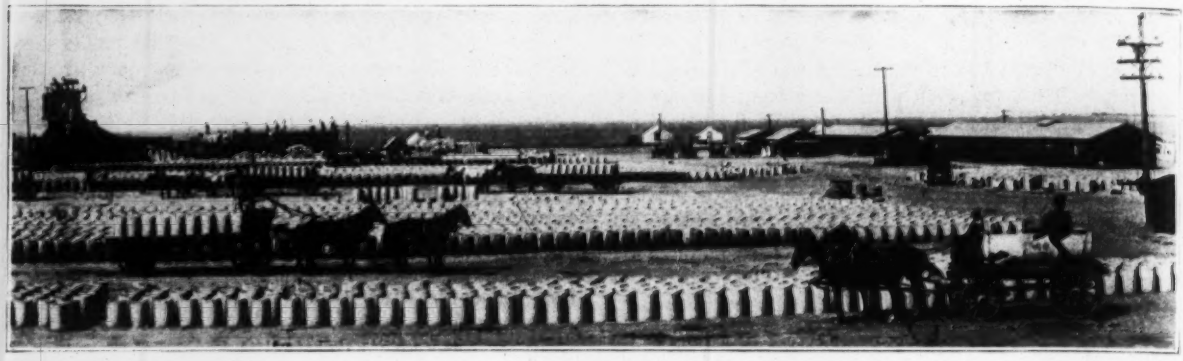
Candidates Should Declare Policies

The commission-manager form of government has been generally accepted as a means of eliminating politics. "Party politics" is eliminated, but not always "politics." Without the party committees there seems to be no one whose duty it is to place before the voters not only the names of men but what principles these men represent. The local charter as well as many others provides for the nominating of the mayor and commissioners by petitions only. The method seems satisfactory when particular issues are at stake. When all is well organized and when there appears to be no issue, the opponents to good government, whose purpose is unknown publicly, circulate their petitions with no opposition. The people elect the candidates as mere men and not for what they represent, and deplorable results follow. Provision should be made whereby the public in general knows before election how each candidate stands relative to the important matters to be dealt with during his term of office and especially whether or not the candidate will uphold the honest and efficient government that the public desires and deserves.

Other communities should join with Cadillac in organizing with a determination to defeat the repetition of such a catastrophe here or elsewhere. Keep clean-cut business men on the commission and the form of government will prove a success anywhere.

Fireproof Column Tests Are Co-operative

Several organizations are coöperating in the conduct of the fire-and-load tests of building columns now under way at the Underwriters Laboratories, Chicago, as reported in the Jan. 31 issue, p. 207. The Associated Factory Mutual Fire Insurance Companies, the National Board of Fire Underwriters, and the United States Bureau of Standards are joined in the work.



(PANORAMA) EASILY THE LARGEST CONCRETE PIPE JOB ON RECORD—HALF A MILE OF PIPE IN 2-FOOT LENGTHS IS TURNED OUT DAILY—CASTING YARD COVERS FIVE ACRES

Cast Half a Mile of Concrete Pipe Per Day

Materials Handled in Central Plant, Concrete Delivered to Yard by Motor Truck on Rails and Carried to Forms in Buggies in Largest Pipe Job on Record

AN ENORMOUS quantity of concrete pipe is being cast at Fresno, Calif., by methods involving machine handling of materials and motor truck distribution which are stated to have proved most efficient. The work is in connection with a 15,000-acre tract of land which is being brought under cultivation by the Boston Land Co. on rush schedule. Although the district is considered excellent grain land, the annual rainfall is only six or seven inches, so that irrigation is necessary. When the project was launched it was determined to get water to the land as quickly as possible, and a contract was made with Bent Brothers, of Los Angeles, for the construction and placing of 125 miles of 14- and 18-in. pipe, under terms of which the pipe is being cast and placed at the rate of about 2000 ft. per day.

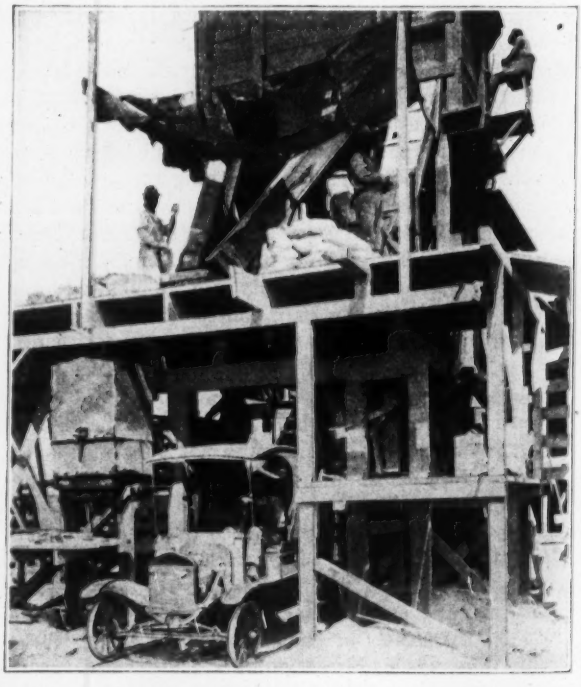
The fact that the tract is almost perfectly level makes it possible to lay out a very comprehensive irrigation system on a simple scale. The source of water is wells, 1200 to 2500 ft. deep, in which the water rises to within about 90 ft. of the surface. From each well is pumped the supply for a 300-acre unit of the cultivated area, which is served through concrete pipe mains 18 in. in diameter, from which branch laterals 14 in. in diameter. At intervals along the main are placed 36-in. concrete standpipes containing gates, baffles, overflows and rotating recording weirs which measure the water being delivered into the connecting laterals. Along the laterals, at the high corner of each 20 acres, are placed 14-in. risers capped with valves for the delivery of water on the ground.

As laid out, the casting yard covers about 5 acres and is operated by a crew of about 100 men. Materials brought in by rail are dumped from hopper bottom cars into compartments under the track, whence dragline scoops convey them to bunkers over the mixers. This dragline arrangement is so devised that one operator controls sand and gravel scoops, which operate independently and which pick up a load of either material desired without requiring an attendant at the loading point.

Concrete is mixed in two Kellar-Thomason mixers of the trough and paddle type, making a thorough dry mix before adding water. From the mixers the concrete goes by chute to a four-compartment steel hopper on a Ford automobile, each compartment having a capacity of 5 cu.ft. This car is provided with double flanged steel wheels and runs on steel rails from the mixer directly across the center of the casting yard.

The forms are set up in rows about 300 ft. long on each side of the center line of the yard in bays. These bays are arranged so that when about 2000 sections of pipe have been cast there will be a roadway between adjacent bays. Two 5-cu.ft. concrete buggies and a wheeler are supplied to each two-man casting crew and these buggies are used to bring concrete from the Ford supply car to the forms.

The mix is handled as wet as it is possible to use it and still have the pipe sections stand without distortion when the forms are removed immediately after



EACH BIN FILLS HAND BUGGY WITH MINIMUM DELAY

ONE MAN OPERATES SAND AND GRAVEL HOISTS

casting, which is not very wet. Each mixer batch contains 3 cu.ft. of cement, 7½ cu.ft. of sand and 4½ cu.ft. of rock, which is in the ratio of about 1:2½:1½. The amount of water per batch is determined by observation, and is approximately 6% by weight. In deciding upon the mixture, primary importance was placed upon securing the maximum density of the mix rather than the maximum strength. The primary requirement will be for impervious pipe rather than for strength.

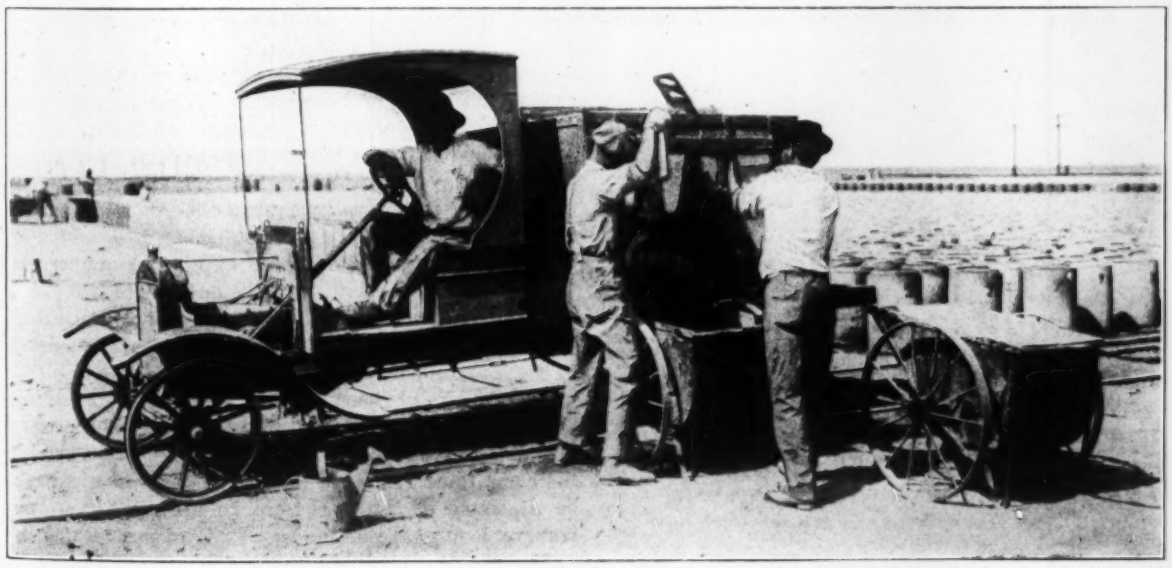
With this method of casting in operation, two sets of forms are all that each three-man crew requires. The forms are 2 ft. long. The usual removable hopper top is used for the forms and one man shovels while the second tamps the concrete into place with a heavy, narrow iron tamper, shaped to the shell of the pipe. When the forms are full the usual heavy cast-iron ring handled by both operators is used to form the bevel edge on the top of the section.

After the forms have been removed, the sections are kept saturated continuously for seven days. That is, during daylight hours men are continually sprinkling the sections. After the seventh day they are given a heavy interior coat of neat cement wash applied with brushes immediately after wetting the pipe thoroughly. Sections are not handled for two or three hours after the application of this finishing coat.

Crews of four men each place the pipe in ditches excavated by trench machines. After placing, the pipe is immediately covered to prevent the joint mortar from drying out in the sun. The average depth of fill over the top of the pipe is about 2 ft. The backfill is placed with teams and road graders. It is the plan to employ a sufficient number of men on each part of the work so that the pipe will be laid as fast as it is cured and ready for use. A single 9-hour shift is employed.

At first a battery of motor trucks was tried out for delivering pipe sections from casting yard to trench, but this was abandoned as uneconomical. If loaded to such a capacity that the use of motor trucks was economical there was difficulty in getting them over the poor roadways without delay. The result was that in order to avoid getting stuck, partial loads would be taken. On this basis it was more economical to use horses, as compared with large trucks. At present the work is being carried on with four-horse teams, each of which handles about 30 sections of pipe per load.

The work was started approximately a year ago and since it has been well under way the progress has been about 200 feet per day. It is estimated that approximately another year will be required to complete the contract.



MIXERS DUMP INTO BINS OF FORD RUNNING ON RAILS

Porous Rock Makes Good Concrete of Light Weight

In Early Tests Lava Rock Proves To Be Acceptable Aggregate, Which May Be of Value for Concrete Ships

FROM noticing a piece of pumice stone afloat, C. E. Barglebaugh, of Lang & Witchell, architects and engineers, El Paso, Tex., concluded that concrete made of light weight lava rock, if possessing the necessary strength, might assist in the solution of the problem of the concrete ship. One of the principal objections urged against this use of concrete has been the fact that ships built of it weigh from 10 to 20% more than steel ships of the same capacity. If, then, concrete can be made light in weight and still of a fair compressive strength a step forward toward its adaptation to shipbuilding has been made.

Acting on these ideas Mr. Barglebaugh had made at the University of Texas a series of tests on concrete cylinders using as coarse aggregate a lava rock which made a concrete averaging about 80% of the weight of limestone concrete. As the accompanying tabulations show, the corresponding compressive strength ratio at the end of one month was between 90% and 100%. Ninety-day tests will be published when available, but the matter is so live that it is thought worth while to give the early results.

The porous aggregate used was a lava rock from New Mexico near El Paso, Tex. It is of a kind found in large quantities all over the western portion of the United States from the eastern foothills of the Rockies to the Pacific coast. Different specimens were tested for crushing strength and gave values for the softest of approximately 3000 lb. per sq.in., while the hardest tested above 5000 lb. per sq.in. Its mechanical analysis was as follows:

	Per Cent
On a 2-in. ring	0 0
On a 1½-in. ring	13 4
On a 1-in. ring	35 7
On a ¾-in. ring	59 2
On a ½-in. ring	74 3
On a ⅜-in. ring	84 8
On a ¼-in. ring	94 6
Passing ¼-in. ring	5 3

Sand and cement were thoroughly mixed dry by hand and stone and water added during subsequent hand mixing. Specimens were kept under moist sand for six days, after which they were kept in the dry air of the laboratory. Testing was done in a 100,000-lb. compression machine. Absorption tests were also made, but results will not be available until after the 90-day period. Comparative tests were made on a limestone concrete of similar physical characteristics.

COMPRESSIVE TESTS ON 1:1 4:3 6 CONCRETE

6 x 12-in. Cylinders. Age 28 Days

Aggregate	No. of Specimens	Wgt. per Cu. Ft. in Lb.	Total Load, Lb.	Unit Load Lb.
Porous rock	3	117	73,233	2,585
Limestone	2	144	75,500	2,670

COMPRESSIVE TESTS ON 1:2 4:5 CONCRETE

6 x 12-in. Cylinders. Age 28 Days

	No. of Specimens	Wgt. per Cu. Ft. in Lb.	Total Load, Lb.	Unit Load, Lb.
Porous rock	3	116	45,533	1,610
Limestone	2	142	58,650	2,058

TENSILE TESTS ON POROUS ROCK CONCRETE

25 Sq. in. Section. Age 28 Days
Average of 3 Specimens

Mix	Wgt. Lb. per Cu. Ft.	Total Load Lb.	Unit Load per Sq. In.
1:1 4:3 6	117	5,303	212
1:2 4:5	116	4,303	173

From these tests it will be seen that in the richer mix there is a loss of strength of 3.2% with a reduced weight of almost 20% from the limestone concrete, while the loss of strength in the lean mix more than offsets the reduced weight. Though promising in some respects, much more experimenting is necessary to determine proper values. Then, too, the porosity of the concrete must be looked into and the possibility of waterproofing this kind of concrete before it can be used in ship work.

The tests were made for the Bureau of Economic Geology and Technology of the University of Texas by S. P. Finch and F. E. Giesecke.

Brick Pavements Being Adapted to Country Roads

Surface Is Practically Indestructible Under Rubber Truck Tires—Monolithic Construction Is Proving Economical

WHILE no fundamentally new features have been developed during the past year, well directed efforts are being made to adapt the vitrified-brick pavement to fit the necessities of rural road construction. It has become obvious that paved country roads which connect centers of population, or which serve considerable areas of farming country, will carry as heavy concentrated truck loads as the ordinary city business street. There exists also an unmistakable tendency to increase motor truck wheel loads. These facts should lead us to give the most careful consideration to the transverse strength, or load supporting capacity, of rural pavements, according to Clifford Older, from whose paper before the recent convention of the American Road Builders Association the following has been taken.

The chipping or spalling and abrasive action, due to sharp shod horses and steel tires, is becoming less pronounced because of the motorization of traffic. When considerable stretches of rural roads become paved, motor traffic may be expected to predominate more quickly than on city streets on account of the greater length of the average haul. A brick wearing surface, laid now, may not be expected to wear appreciably under the traffic conditions likely to apply during its life. The anticipated eventual elimination of the spalling action of steel-tired, horse-drawn traffic fosters a tendency to use bituminous and sand fillers. As the use of either of these fillers obviously results in reducing the transverse strength or load supporting capacity of the pavement below that of one of the monolithic type having the same total thickness, the use of these fillers should be accompanied by a corresponding increase in the transverse strength of the base.

The growing tendency to use 3-in. rather than 4-in. brick with bituminous fillers seems logical, since the base, which furnishes the transverse strength, may be

made thicker, and therefore stronger, without increasing the total thickness or cost of the pavement.

Three-inch lug-brick, laid with a cement grout filler directly on a concrete base or on a sand cement bed on a concrete base, should provide as great transverse strength as 4-in. brick used in the same way, providing the total thickness of the pavement and the proportions used in the concrete base are the same. This conclusion is supported by the tests made by Prof. Wiley of the University of Illinois and reported in *Engineering News-Record*, Nov. 1, 1917, p. 820. These tests, while perhaps not conclusive, indicate strongly that the so-called monolithic types of brick pavements are truly monolithic as far as transverse strength is concerned. The 3-in. brick used in this way should provide ample wearing resistance for present traffic conditions, and has the advantage of economy of first cost. To use the same base for a 3-in. as for a 4-in. monolithic brick pavement under the same traffic conditions, or to substitute a bituminous filler, would be illogical.

Monolithic and semi-monolithic (sand-cement cushion) brick pavements are deservedly becoming popular. The greater difficulty encountered in rolling the brick to an even surface has led to a tendency toward more rigid specifications for rolling and for brick of more uniform thickness. Brick of uniform thickness may readily be handled so as to produce the necessary smoothness of finished surface. The ordinary variation in thickness need present no serious difficulty, however, if the base is carefully laid and the rolling is properly controlled.

Arguments are being advanced for the use of water-bound and bituminous-macadam bases for brick pavements for rural roads. It is the experience of the writer that for heavy motor-truck traffic, and under the conditions of frequent rainfall—which in Illinois at least make it difficult and costly to prepare a uniform sub-grade—it is economically impracticable to build a road of this character that will not become depressed in the wheel tracks or other well defined areas. If not worn out, old macadam roads of proper width and having suitable grades may well be resurfaced and used for the base, for the weak spots are usually eliminated during the first years of maintenance. Such roads are, however, hard to find in Illinois.

There is a definite field for brick country roads where traffic conditions demand wear resisting qualities, but it would seem to be a mistake to sacrifice any of the distinctive qualities of well-built brick pavements in order to bring them into competition with essentially cheaper types—or for any other reason.

Coal Tar Bond for Portland Cement Concrete

Recently the concrete roads of Wayne County, Michigan, were repaired in certain places and widened from 16 to 20 ft. On the resurfacing a rather unusual procedure was followed which so far, after a year's wear under average heavy traffic conditions, seems to have proved very satisfactory. After the old concrete surface had been leveled it was wet down with water and slushed with a hot mixture of tar, upon which the fresh concrete was deposited. The surfacing as well as the shoulder extension was reinforced, and while some cracks have appeared, none has developed seriously.

Electrification Urged To Solve Railroad Problem

E. W. Rice, Jr., Thinks Possible Saving in Coal and Increase in Operating Capacity Justify Immediate Program

RAILROAD electrification on a large scale is regarded by E. W. Rice, Jr., president of the General Electric Co., Schenectady, N. Y., as the quickest and most effective solution of our transportation problem. As president of the American Institute of Electrical Engineers he expressed to that society, at the midwinter convention Feb. 15, the belief that if the roads of the country were now electrified no breakdown of our coal supply due to failure of distribution would exist. He pointed out that electric equipment does not fail as steam locomotives do in extreme cold weather; that where coal is necessary for generating electric power, far less must be used—and transported over crowded railroads—than steam locomotives would need; and that electric operation in many parts of the country affords opportunities to utilize water power. He therefore felt that in spite of the many other demands on the country's money at this time, electrification should be undertaken at once to prevent next winter as far as possible a recurrence of the congestion of this winter.

These notes are taken from Mr. Rice's address:

Electrification Increases Track Capacity

Where electricity has been substituted for steam in the operation of railroads, fully 50% increase in available capacity of existing tracks and other facilities has been secured. This increased capacity has been due to a number of causes, but largely to the increased reliability and capacity of electric locomotives under all conditions of service. They thus permit a speeding up of train schedules by some 25% under average conditions. Of course, under the paralyzing conditions which prevail in extremely cold weather, when the steam locomotives practically go out of business, the electric locomotives make an even better showing. At a time when the steam locomotive is using up all of its energy by radiation, leaving practically no useful power available to move the train, the electric locomotive is operating under its most efficient conditions, and may even haul a greater load than in warm weather.

Something like 150,000,000 tons of coal, it is estimated, was consumed by the railroads in 1917. Results obtained from the operation of such railroads as are already electrified in this country show that it would be possible to save at least two-thirds of this coal if electric locomotives were substituted for the present steam locomotives. On this basis there would be a saving of more than 100,000,000 tons of coal in one year. This is an amount three times as great as the total amount of coal exported from the United States during 1917.

The carrying capacity of our steam roads is also seriously restricted by the movement of coal required for hauling the trains themselves. It is estimated that fully 10% of the total ton-mileage movement is made up of company coal and coal cars, including in this

connection the steam engine tender and its contents. The revenue carrying capacity of our steam roads could be increased about 10% with existing track facilities by elimination of the entire company coal movement.

It is estimated that there is not less than 25,000,000 hp. of water power available in the United States. If this were developed and could be used in driving our railroads, each horsepower so used would save at least 6 lb. of coal now burned under the boilers of our steam locomotives for each horsepower-hour developed. This water power is not uniformly distributed in the districts where the railroad requirements are greatest, but the possibilities indicated by the figures are so impressive as to justify careful examination as to the extent to which water power could be so employed.

Where water power may be utilized, as in our mountainous districts in the West, all of the coal used for steam locomotives can be saved. In the Middle and Eastern states water powers are not sufficient, and it will be necessary in a universal scheme of electrification for the locomotives to be operated from steam-turbine stations. However, as already stated, the operation of the electrified railroads from steam-turbine stations will result in the saving of two-thirds of the coal now employed for equivalent tonnage movement by steam locomotives.

Keeping Pace with Country's Development

We have had enough experience upon which to base a fairly accurate determination of the stupendous advantages and savings which will surely follow the general electrification of the railroads. There is, it can probably be demonstrated, no other way known to us by which the railroad problem facing the country can be as quickly and as cheaply solved as by electrification. If it is a fact that the steam railroads of the country have failed to keep pace with the country's productive capacity, with the increase in output of manufacturing industries, and the extension of agriculture and other demands for transportation, then it is obvious that if the country is to go ahead the railroad transportation problem must be solved, and it must be solved at the earliest possible date. It becomes a matter of national importance that the best solution should be reached in the shortest possible time. That solution is best which will give the greatest amount of transportation over existing tracks in the most reliable manner and, if possible, at the lowest operating cost. As electrical engineers we are confident that we can make good our claim that the best solution is to be found in a general electrification of the railroads.

We could not be so confident of the benefits of electrification of railroads if every element in the problem had not been solved in a thoroughly practical manner. The electric generating power stations, operated either by water or by steam turbines, have reached the highest degree of perfection, efficiency and reliability, while the transmission of electricity over long distances with reliability has become a commonplace. Electric locomotives capable of hauling the heaviest trains at the highest speeds over the heaviest grades have been built and have been found in practical operation to meet every requiremnt of an exacting service. There is, therefore, no element of uncertainty, nothing experimental or problematical, which should cause us to hesitate in pressing our claims upon the attention of the country. Electrification of railroads has progressed with relative slowness during these many years, waiting upon the development and perfection of all of the processes of generation and transmission and of the perfection of the electric locomotive itself. When all of these elements had been perfected, as they now have been for several years, the railroads found themselves without the necessary capital to make the investment.

Electrification Need Not Be Universal

The task of electrifying all of the steam railroads of the country is one of tremendous proportions. It would require under the best of conditions many years to complete and would demand the expenditure of billions of dollars. The country, however, has clearly outgrown its railway facilities and it would require, in any event, the expenditure of billions of dollars and many years of time to bring the transportation facilities up to the country's requirements. It is not necessary that electrification should be universal in order to obtain many of its benefits. Probably the most serious limitations of our transportation system, at least in so far as the supply of coal is concerned, is to be found in the mountainous districts and it is in such situations that electrification has demonstrated its greatest value. Electrification of a railroad in a mountainous district will in the worst cases permit double the amount of traffic to be moved over existing tracks and grades. If a general scheme of electrification were decided upon the natural precedure would therefore be to electrify those portions of the steam railroads which would yield the greatest results and give the greatest relief from existing congestion.

It may be said that the present is not a propitious time in which to deflect any of the country's money into railroad electrification. But the question for the country to decide is whether we dare risk restricted production, due to limited transportation, at a time when the world demands and expects from us the greatest possible increase in our efficiency and total production. What assurance have we that the present conditions are temporary, and even if they improve, as they surely will, with the coming of warm weather, what are we going to do next winter? Of course, even if we should start electrification at once we could not have all our railroads electrified by next winter, but we could have made a good start.

Individuals, Not Companies, File on Water

Actual reclamation development by settlers is indicated by the records of filings for water rights in Colorado in 1917. The claims were made almost entirely by individuals rather than corporations and were mainly for gulches and small streams in the higher plateaus, 90% being on the western slope, according to A. J. McCune, state engineer. These claims included 248 for ditches for direct irrigation, 59 for reservoirs, and 24 for ditches and pipe lines for power, mining, milling and manufacturing. Based on 100 acres per second-foot the amount of water claimed represents 100,000 acres. Estimated cost of construction of the several ditches and reservoirs amounts to $564,742.

Freight Station and Warehouse Has 23 Acres of Floor

Six-Story Structure of Standardized Design Houses L. C. L. Clearing House—First of Industrial Group Interconnected by Tunnels for Trucking

ONE of the largest reinforced-concrete buildings in the world is a six-story combined freight station and warehouse recently constructed in Chicago. Covering a site of 3½ acres, it has nearly 23 acres of floor space. Five upper floors are for storage. The first floor and basement will be used as a central freight station serving not only this warehouse but also a group of about 70 six-story buildings to be erected for industrial and manufacturing purposes. These buildings will average 30,000 sq.ft. for each floor. They will be connected with the freight station by tunnels for trucking, and all pipes, conduits and other utilities will be laid in tunnels. A power-house and cold-storage warehouse already are built.

All the structures are for the Central Manufacturing District, a corporation which owns a similar group of buildings already in use. The construction plant and methods employed at the station and warehouse were described in *Engineering News-Record* of Aug. 9, 1917, p. 267. This one building cost about $1,350,000, while the cost for the entire group will be approximately $18,000,000.

The building is 590 x 275 ft. in plan, six stories high, with nearly 20 acres of floor area, or 23 acres including the freight platforms and track space. As the cubic content from 4 ft. below the basement floor to the top of the coping is 13,617,000 cu.ft., the cost per cubic foot is a little less than 10c. Standardization of design and architectural treatment for the entire group of buildings contributed largely to the low cost, owing to the facility of construction and the purchase of material in large quantities at wholesale prices. The structural materials in this one building include 42,000 cu.yd. of concrete and 2700 tons of reinforcing steel.

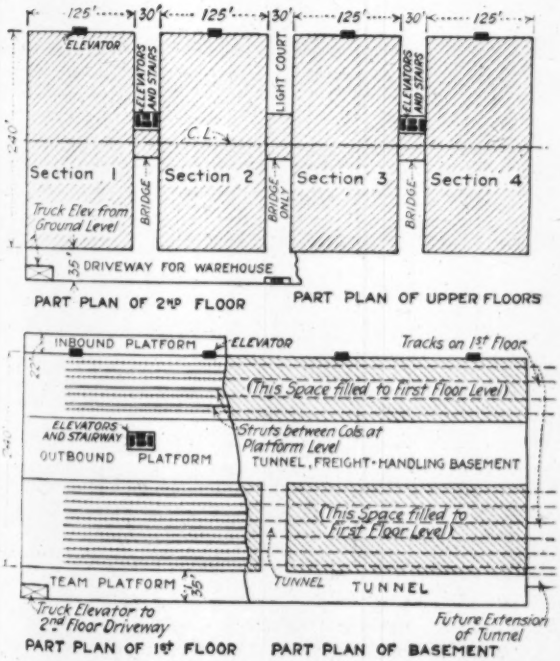
Structural design is of the loft type, with circular columns and flat-slab floors and roof. Window areas are large, and are fitted with steel sash. Doors and door frames also are of steel. The structure is fire resistent, and has sprinkler equipment throughout for the protection of its contents. The exterior finish is of dark-red face brick and cream-colored terra cotta;

INTERIOR OF ONE OF THE WAREHOUSE FLOORS SHOWS TYPE OF CONSTRUCTION

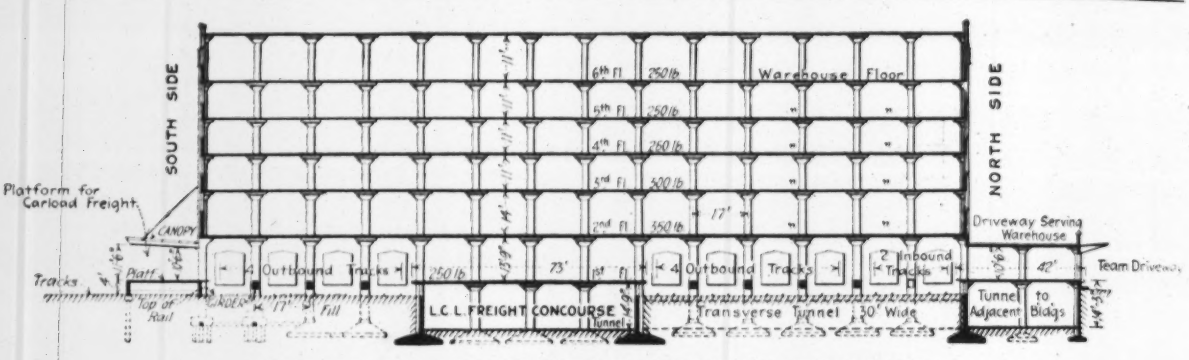
the steel sash and concrete spandrels are painted green. Although the brick facing was not started until after the completion of the roof, it was done in 24 working days. This included the placing of 2,400,000 common brick, 1,000,000 face brick, and 376 tons of terra cotta. This work was done by a force of 300 men. The force on the concrete work for the construction of the building numbered about 900 men.

Column spacing, 17 x 17½ ft., was governed largely by the track spacing on the first floor. A 14-ft. clearance was required for the tracks, and this dimension plus the size of the columns gave 17 ft. spacing, which was also found the most economical spacing for the given loads. The live-loads are 250 lb. for the first floor, 350 lb. for the second, 300 lb. for the third, and 250 lb. for the three upper floors. The interior columns are circular and the exterior columns rectangular, with beveled corners. Between the tracks the columns extend uninterrupted from the footings to the second floor, and these tall lengths are braced by longitudinal girders. The girders are at the level of the freight platforms and serve to support the movable plates or bridges on which trucks are wheeled through the cars.

Floor slabs are finished to stand wear and trucking, but no special hardener was used in the surface. The concrete was made with as little water as possible, and after being leveled in the forms a small addition of cement and sand was spread over the surface. This was worked in by thorough troweling and floating so as to make a hard and wear-resisting finish. The slab thickness is 8¾ in. for the 350-lb. load, 8 in. for 300 lb. and 7½ in. for 250 lb. The roof is a 6-in. slab,



GENERAL PLAN OF STATION AND WAREHOUSE FLOORS



CROSS-SECTION THROUGH STATION, WAREHOUSE AND TUNNELS

covered with three-ply roofing bedded in asphalt and having an asphalt top coat. All stairways are of concrete.

The spandrel walls are of concrete, and a feature of the construction is that the pouring of these was left until after the completion of the brick facing of the building. This is said to admit of better alignment of the brick, as it avoids the chipping to fit around pilasters and columns which is necessary where brick spandrels are carried by a shelf poured with or attached to the concrete frame. The arrangement enabled larger window openings to be used. It also avoided the usual necessity of cleaning brickwork from the drippings of superimposed concrete, the brick facing being used only on the vertical strips between the spandrel walls and window openings.

Horizontal rods in the columns projected into the spaces to be filled later by the spandrel walls. Similar bars embedded in the floor slabs had the projecting ends bent upward. In this way the reinforced-concrete walls were securely anchored to the columns and floor slabs already built.

This construction was economical, since an 8-in. spandrel of concrete was considerably cheaper than the 18-in. brick wall which would have been required by the city building code. With this method large openings were left extending from the second to the sixth floor, as shown in one of the accompanying views. This facilitated the work of the crews of the various subtrades in getting their materials into the building.

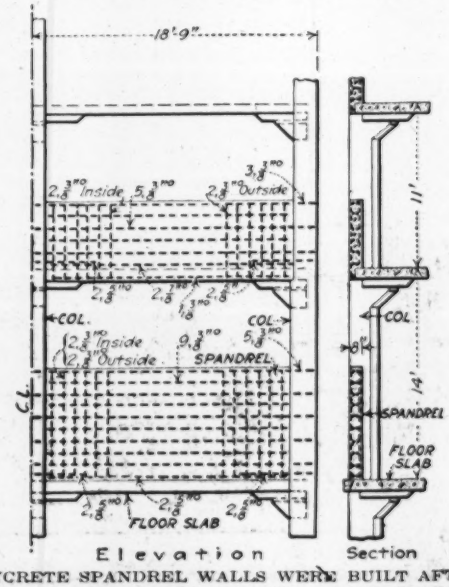
The site was vacant land and partly a city dump at 39th and Robey Sts., near the bank of the Bubbly Creek arm of the Chicago River. This arm has now been filled. The foundations are spread footings, except that Raymond concrete piles are used near the creek. Where the old dock line made it impracticable to use these piles, open shafts were sunk for concrete piers. These were carried to hardpan, the bottom shaft being belled out to twice the diameter of the shaft.

Good blue clay being found only about 4 ft. below the surface, it was economical to strip the entire area with a steam shovel, instead of excavating for individual foundations. This left only about 1 ft. of hand excavation for the footings. The spaces to be occupied by tracks on the first floor were afterward backfilled to the track level.

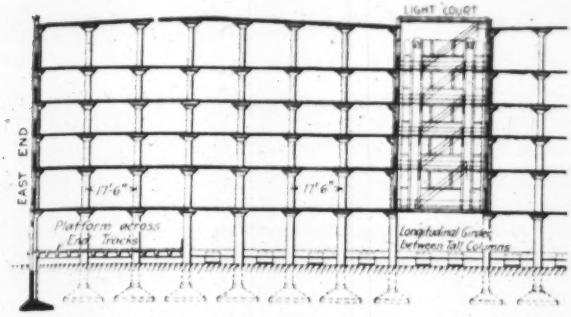
In the five upper floors the building is divided into four units 125 x 240 ft., separated by 30-ft. spaces, and having light on all sides. These units are connected across the 30-ft. open spaces by narrow sections in which are electric elevators extending to the central outbound platform of the freight station on the first floor. This entire upper portion of the structure has been leased to Montgomery Ward & Co. for 25 years for warehouse purposes. There are ten elevators of 5000 lb. capacity, 8 x 12 ft., with speeds of 300 and 400 ft. per min.

Special facilities for access to this part of the building by the lessee had to be provided, as all the street frontage on the first floor is required by the freight station for the receipt and delivery of package freight. A roadway therefore is constructed at the second floor level. This is built over the inbound platform on the first floor, which thus becomes a covered space. The upper roadway is paved with wood blocks. Wagons and motor-trucks have access to it by means of two inclosed 7½-ton electric elevators, one at each end of the roadway.

The collection and distribution of freight for a large group of industries by the central station or clearing-house method is one of the special features of the plant. The first floor will form a union station for incoming and outgoing "less-than-carload" freight or freight in small lots. This station will be 590 x 275 ft. in plan. Beneath the platforms is a basement, which forms the



CONCRETE SPANDREL WALLS WERE BUILT AFTER COMPLETION OF COLUMNS AND FLOOR SLABS



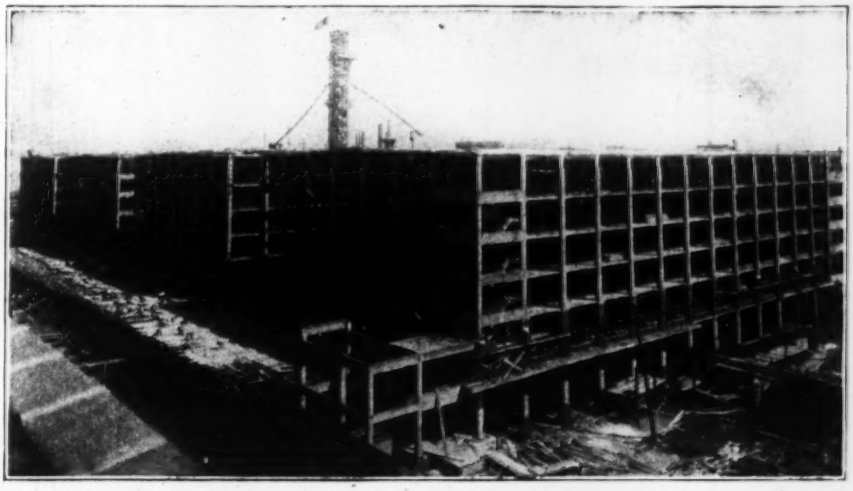
LONGITUDINAL SECTION THROUGH END OF HOUSE

receiving and distributing station for the industries in the group of outlying buildings. It will be connected with these by a system of tunnels extending about half a mile in both directions, and having elevators to serve the several buildings. In these tunnels the package freight will be transported on specially designed trucks hauled by electric tractors.

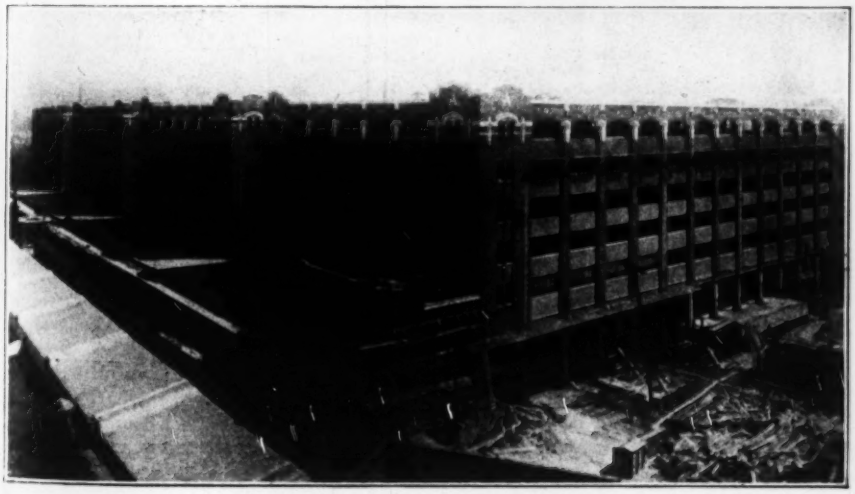
On the first floor there will be eight stub tracks 550 ft. long for outbound shipments, four on each side of a central platform 70 x 590 ft. Here trap or collecting cars from the several industries will be unloaded, and the contents classified and placed with the package freight received through the trucking tunnels. This outbound freight will then be loaded into cars for shipment. Two stub tracks 450 ft. long are provided for trap cars which bring inbound freight from the stations of the various trunk lines entering Chicago. Here the freight is unloaded to be placed at the disposal of the several industries, or lowered to the basement for distribution by the tunnel trucks and tractors to the group of buildings.

Carloads of incoming freight for the warehouse are accommodated on two tracks 590 ft. long, with a 20-ft. platform having elevators to the five upper floors. Two tracks at grade will extend through the group of buildings and provide for direct handling of the carload business of the several industries. All of the tracks will be operated by the Chicago Junction Ry.

Heat, electric light and sprinkler service for the present structure and the entire group of buildings will be supplied from a central power station. The lighting plant is designed on the basis of 4 watts per sq.ft. for the office sections and ½-watt per sq.ft. for the remainder of the building. For the water service there is a two-story elevated tank in the tower of the power station. The upper part is for the sprinkler service and the lower part for the domestic service. This



STRUCTURAL FRAMEWORK WITH FLOORS AND ROOF COMPLETED BEFORE SPANDRELS AND CURTAIN WALL WERE BUILT (VIEW TAKEN AUG. 2, 1917)



CHICAGO FREIGHT STATION AND WAREHOUSE WITH 23 ACRES OF FLOOR SPACE—NORTH FRONT HAS SECOND-STORY DRIVEWAY REACHED BY ELEVATORS (VIEW TAKEN AUG. 23, 1917)

building and all the others of the group are of the same general type as the freight station and warehouse.

The buildings have been designed by S. Scott Joy, architect for the Central Manufacturing District. John L. McConnell is assistant architect. The structural design and all concrete detailing were handled by the Concrete-Steel Products Company as structural engineers. The contractor for the present work is the E. W. Sproul Company.

Illinois Has $17,000,000 for Road Work in 1918

For road construction and improvement in Illinois during the coming season there is available about $9,000,000, including the county, state-aid and Federal-aid funds. In addition there is about $8,000,000 provided by the townships for the maintenance of township roads and bridges. Under the state law the greater proportion of the former amount will be expended in the construction of roads forming continuous routes, rather than laid out in providing scattered sections of good roads.

Pennsylvania Keeps Roads Open for Army Motor Convoy

Work Falls on Maintenance Section of State Highway Department, Which Organized Equipment and Forces Long in Advance

BY GEORGE H. BILES
Second Deputy State Highway Commissioner, Harrisburg, Pennsylvania

ANTICIPATING trouble from deep snows, the Pennsylvania Highway Department prepared long in advance to keep open the route that was being followed by the Army motor truck convoy from Detroit and Cleveland to the Atlantic ports. Arrangements were made with the Pittsburgh office of the Weather Bureau to furnish advance information upon which the machinery could be started to prevent a complete blockade. The work was placed under the direction of the maintenance division of the department, and trucks equipped with snowplow attachments were stationed at the larger towns along the route. The work of these was supple-

ALL TYPES OF EQUIPMENT WERE USED TO OVERCOME THE HEAVY SNOW

mented by road drags and machines and by the liberal use of labor.

The first snow of any consequence occurred Dec. 6 and 7, and was general over the entire route. For many miles the drifts averaged from three to six feet in depth. In these cases the work was begun by breaking a track through the drifts with teams and drags. This was followed by the road machines or trucks with plow attachments and shovelers. Turnouts were made along the line and thereafter the road was widened to between 14 and 16 ft., depending upon the location. The entire travelable width of roadway was finally opened in order that traffic would not track and cut through the road surface during periods of freezing and thawing. The snow at first was removed to within three inches of the road surface and what did not melt was afterward removed entirely. Through the deep cuts, after a track was broken, it was necessary to resort to shoveling.

As soon as any section of the road was opened, shovelers followed, cutting openings from the side to the ditches at various intervals along the road. When this work was completed the road was again turned over to the caretaker or patrolman to look after the drainage details.

From observations taken since 1913 it has been found that at certain locations snow fence would be advantageous and economical. Although it was impossible to put all the necessary fence in place this season, some of it has been constructed and before another season arrives the remaining sections will be provided.

Work Done With Night and Day Shifts

There were certain sections along the line of the route where it became necessary to work night and day shifts, and since the organization was perfected each succeeding snowfall has been handled with increased alacrity and efficiency.

In the beginning the work was accomplished with the following organization and equipment, which has been augmented from time to time: Seven motor trucks and plows, 22 road machines, 20 drags, 105 teams, 3 tractors and 200 men.

The patrol force of thirty-four men is continuously engaged in repairing and patrolling this highway, each man looking after his particular section, and this plan is an important factor in reporting emergency conditions of consequence to the district head or superintendent, who reports by wire or phone direct to the main office. The caretaker is empowered to organize forces, if need be, to take care of conditions until the arrival of the superintendent. If the conditions are unusual, the superintendent reports by phone to the assistant engineer, who arranges to inspect and handle the work.

The report is followed by a postal-card report form giving details and is addressed to the main office at Harrisburg. This information is charted as soon as received and the same practice is followed upon the completion of the work. If the drifts are abnormal and the road is not opened within twenty-four hours, the office must be advised by wire and in this way headquarters is in direct touch with and control of the entire route at all times.

Operating Problems of Imhoff Tanks Passed in Review

Normal Sludge Digestion Depends on Enzyme Liquefaction Overbalancing Bacterial Decomposition —Foam—Scum

A COMPREHENSIVE review of the operating problems of Imhoff tanks formed the larger part of a paper by George W. Fuller, consulting engineer, New York City, read before the New Jersey Sewage-Works Association on Feb. 15. The paper was concerned with small rather than large plants. Mr. Fuller's admirable summary of his observations on Imhoff tanks is here given in full:

1. Small plants of the Imhoff tank type, receiving the flow of separate sewers, are frequently more difficult to operate than larger ones receiving the flow of combined sewers, because the relatively large suspended particles reaching the digestion chamber respond for long periods at a time to flotation rather than sedimentation.

Keep Solids in Their Place

2. Careful attention to the prevention or frequent removal of stranded solids in the collecting sewers, inlet channels of the tanks and on the bottom and sides of the upper or sedimentation compartment; to the uniform distribution of solids in the several sections of the tanks; to the frequent removal of grease and scum from the surface of the sedimentation compartment, is helpful and important. But it will not necessarily eliminate abnormally long periods for the "ripening process," following which well digested sludge is obtained without objectionable odors.

3. Normal digestion of sludge to an inodorous humus mass, with a fairly uniform liberation of the resulting gases caused by the inevitable splitting apart of carbon, hydrogen, nitrogen and sulphur atoms contained in the complex molecules of suspended organic substances, is seemingly effected by enzymes or liquid ferments excreted by certain kinds of bacteria.

4. When tanks are new, and when for any unforeseen reason old tanks lose their efficient digestive functions, ordinary bacterial decomposition predominates over enzyme digestion; with attending possibilities as to odor complications from incompletely digested sludge, or from the release of intermediate decomposition products, particularly those of a sulphurous nature, or from both. Tanks in this condition are said to be undergoing the "ripening process," which fortunately does not seem to be necessary, as a rule, other than with new tanks, although there have been some exceptions to this general experience.

Ripening Period Cannot Be Predicted

5. There is no way of telling in advance how long a period of ripening may be necessary for a given tank, as different results come in different units of the same plant. Some kinds of bacteria grow prolifically and preclude the development of suitable enzyme-producing bacteria as a result of "bacterial antagonism" caused by the excretion of waste products. This may be as capricious a matter as the occurrence of weeds in a field

or of algæ in an unpolluted lake. "Seeding" a tank with ripened sludge from another tank has not proved to be as reliably helpful as was expected.

6. Objectionable odors may arise in varying degree, depending upon local factors, but largely upon the lack of opportunities for absorption of odoriferous compounds by surrounding water and upon accumulations of gas which may be released intermittently in masses or "whiffs" so to speak, following barometric changes and interruptions in free venting.

Secret of Successful Tank Operation

7. The secret of success in operating Imhoff tanks is to retain in them relatively small quantities of decomposing solids and to do all that is practicable to secure a proper balance between enzyme liquefaction and bacterial decomposition with a predominance, of course, of the former. This explains why tanks receiving only relatively small quantities of sewage when new do so well in digesting sludge. It raises the issue of sludge storage capacities.

8. Quiescent masses of sewage solids, either scum or bottom sludge, are scarcely capable of satisfactory decomposition as antagonistic products of bacterial life seem to have a decidedly retarding effect.

9. Lime will lessen excessive acid formation in sludge, but it will scarcely cause the establishment of the right kinds of bacteria for enzyme production. In fact, it may result in increasing abnormalities.

10. Agitation by pressure water jets or paddling may be of aid. In Europe, mechanical stirring devices have been proposed. The benefit of stirring and mixing seems to lessen with increasing volumes of sewage solids in a tank, due to a loss of efficiency of the stirring arrangeemnts. This step if carried too far may also remove entrained gas to such an extent that non-gaseous, sticky, foul-smelling sludge is obtained under circumstances requiring its removal and burial or treatment with a deodorant.

Floating Scum and Acid Foaming

11. Acid foaming at gas vents sometimes becomes very bothersome where the gas vents contain large quantities of floating scum undergoing bacterial decomposition in the absence of adequate enzyme digestion.

12. Slot trapping by gas and gas-lifted solids, which fill the space above the slots, frequently accompanies foaming and may carry decomposing solids into the settling compartment from the sludge chamber below as well as by overflowing from the top of the gas vents.

13. Overflowing from foaming cannot be stopped in some tanks even if the gas vents be extended 5 or 10 ft. or more above the flow line. High freeboard, housing with pressure water, stirring and liming, all tend to help, but collectively may not be a prompt cure. Aggravated cases are not cured by putting a tank out of service for months. In some tanks, sludge removal from the bottom affords a remedy, but this is not available for tanks containing most of the solid matter in a floating condition. The surest remedy in such cases is to remove the great bulk of floating solids from the gas vents until only small quantities remain. Obviously such removal must be done in a way to minimize offense.

14. Scum storage for floating solids above the elevation of the slot should be provided for much more liberally than hitherto for small plants, expected to receive during the first year of their operation a substantial proportion of their normal daily quantity of sewage.

15. Scum removal may be necessary in some plants even where there is fairly liberal allowance for scum storage. It depends partly on intensity of gasification, partly on the adhesiveness of the scum (gas-retaining capacity) and partly on the success attending efforts to make portions of the sludge remain in the lower part of the digestion chamber. In aggravated cases scum removal is imperative, but it should be carried out with caution.

16. Scum prevention comes about in some degree through comminution incident to pumping and may be further aided through the use of screens. Sometimes screening is provided in front of pumps. At Rochester, N. Y., the flow of a gravity outfall sewer now passes through a fine screen on its way to Imhoff tanks. Similar provision has been recommended at Plainfield, N. J. Such a step adds materially to the cost of sewage treatment, but evidence at Reading, Philadelphia and Chicago shows that it reduces scum formation to a substantial degree. Its advisability for a given project depends upon whether the need is commensurate with the cost.

Should Note Sludge Condition Before Removal

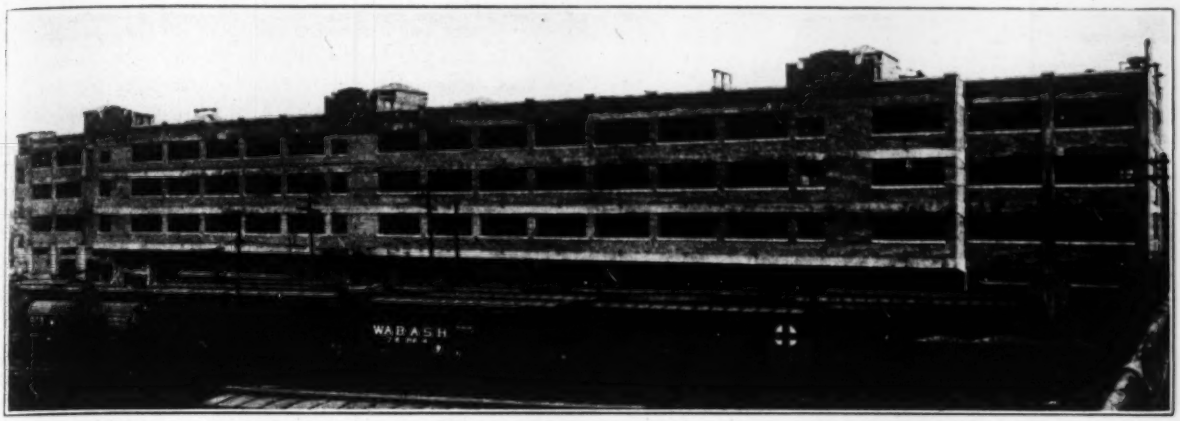
17. Normal Imhoff sludge is dark-colored, practically inodorous and shows a curdled appearance when it flows in a thin layer down the side of a container. Much difficulty with odor has followed the withdrawal of undigested sludge to a drying bed, and an operator should carefully note the condition of the sludge before and during its removal. But difficulty has also resulted from retaining sludge for a year or more in a tank under conditions where suitable enzyme digestion does not prevail. Such sticky gray or yellowish sludge may be foul-smelling, but it is wisest in some cases to remove it, with greatest care taken to prevent nuisance from odors. Complete digestion is not always attainable.

18. Sludge storage capacities are provided more liberally than formerly and with good reason. It is not unusual to find extremely thin or dilute sludge in a digestion chamber and this high water content is quite a factor in causing a demand for larger sludge chambers. Another item is the relatively long period of cold weather during which little or no sludge can be removed. This applies particularly to northern plants put in service during the late summer or fall.

19. Sludge beds should be at least double the areas recommended by Dr. Imhoff, due to the frequency and intensity of rainfall in our northern states—unless covers of the greenhouse type should be provided.

20. It is well to empty idle tanks and conduits; otherwise offensive odors may ensue.

Regardless of method of treatment, Mr. Fuller advised that each plant operator keep daily records of volume of sewage treated, stability of effluent by his methylene blue test, volumes of solid in influent and effluent and other pertinent performance data.



LONG CONCRETE WAREHOUSE HAS THREE UPPER FLOORS OVERHANGING RAILWAY SIDING

Cantilevers Carry Concrete Floors Over Loading Platforms

In Large Reinforced-Concrete Warehouse at Buffalo Special Design of Exterior Panels on Both Long Sides Permits Extension of Upper Stories

IN A large reinforced-concrete warehouse completed last year for the Schoellkopf plant of the National Aniline Chemical Co., Inc., at Buffalo, N. Y., the outside panels on both long sides were carried for three stories and roof on cantilevers extending out from the interior row of columns in order to permit a clear loading platform on one side and roadway on the other. The detail design of the cantilevers, while not extraordinary, is informing as to the methods taken to meet the conditions imposed.

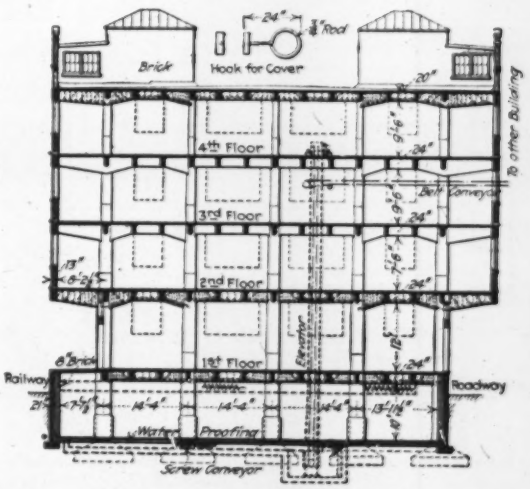
The foundations of the building are 68 x 400 ft. in plan, one long side being on a railway siding and the other on a 30-ft. driveway between buildings. The loading platform on the railway side had to be kept clear of columns, and the driveway width, while required for traffic, did not have to continue at 30-ft. to the top of the building, so on both sides the outer panels for most of the length of the building were designed as overhangs. The railway side wall was kept just above the retaining wall of the basement there and the roadway side extended out to make a total width in the upper stories of 76 ft. This resulted in a gain of nearly 30% in usable floor space for each of the top three floors.

The floors and roof are of beam and girder construction throughout, in panels of 14 ft. 4 in. transversely and 18 ft. longitudinally. The columns are round and spiralled except for the lower tiers in the outside row, which are square and reinforced with straight rods and hoops 12 in. on center. The beams and girders inside the building were made of the same depth, which simplifies form work somewhat but requires the bottom bars of the beams to be bent at the ends to clear the girder steel.

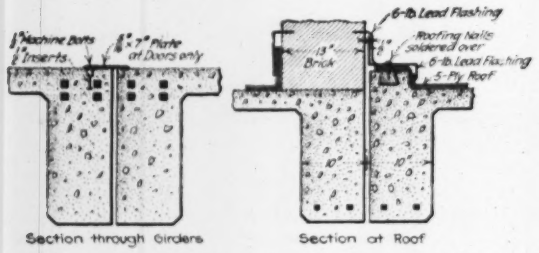
The cantilever girder design is shown both in the general cross-section and on the reinforcing detail drawing herewith. In order to relieve the outside row of columns from excessive bending when the cantilevers were fully loaded, with no live-load on the adjacent interior girder, the cantilever girder *A* steel was carried through into the adjacent girder *B*. The point of inflection for girder *B*, the right hand being considered fixed for the above condition of loading, is approximately at midspan and a considerable amount of tension steel is therefore required in the bottom of this girder near the interior column to provide for the negative moment at this point. It will be noted that the clearance height for girder *B* is maintained the same as for *C* to allow the sprinkler piping, shafting, etc., to be run at the same elevation in all bays.

An accompanying diagram illustrates the method of computing the stresses and designing the cantilever girders.

Another novel feature for a concrete building is the conveyor system which is outlined in part on the cross-section. Large amounts of salt in bulk as well as ground iron are handled daily in this building. The salt is unloaded directly from the cars into the basement



CROSS-SECTION OF SCHOELLKOPF WAREHOUSE, SHOWING CANTILEVER PANELS AND CONVEYING SYSTEM



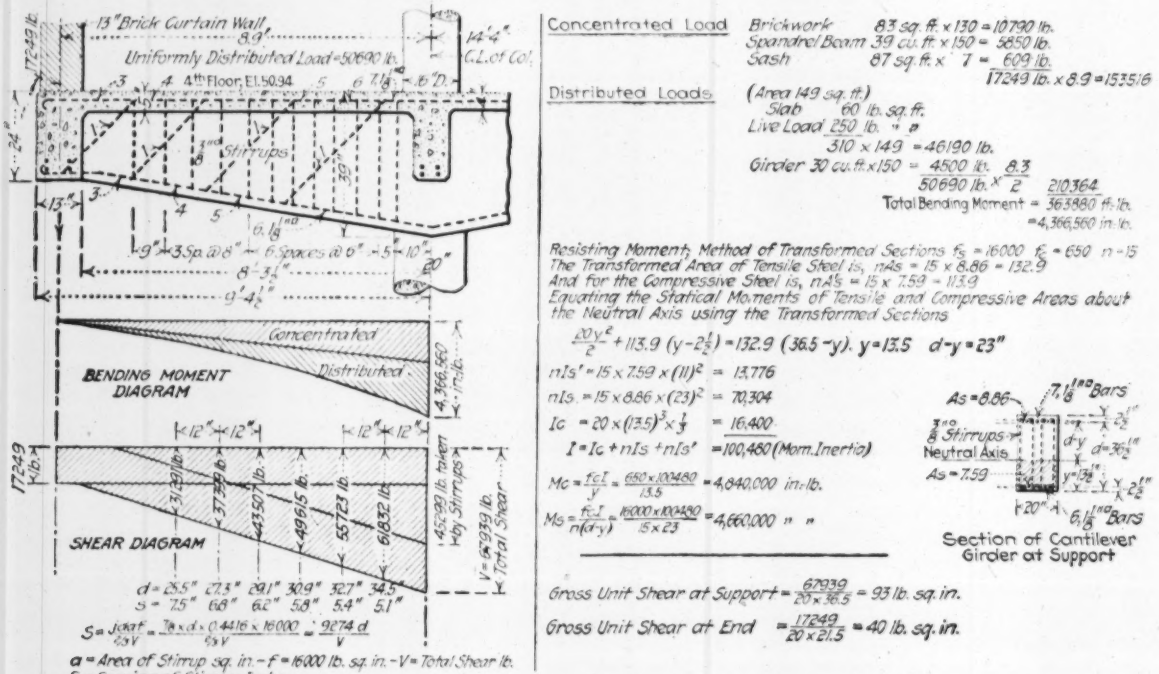
EXPANSION JOINTS ON LONG CONCRETE WAREHOUSE

through openings in the loading platform. It is reclaimed from the basement by means of 14-in. screw conveyors located in trenches in the basement floor. These conveyors deliver the material to the boot of a two-strand steel bucket elevator. This elevator carries the material to the fourth floor and delivers to a belt conveyor which conveys the salt to a building on the opposite side of the driveway. The conveying and elevating system has a rated capacity of 40 tons per hour.

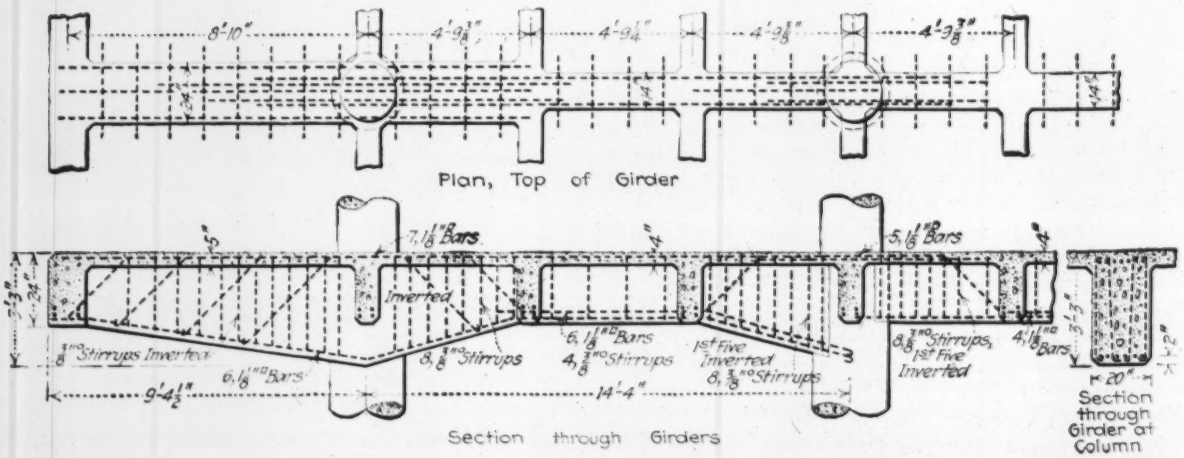
This building is four stories in height with basement and was designed for a live-load of 250 lb. per sq.ft. on all floors. There were 6375 cu.yd. concrete and 585 tons of reinforcing steel used in its construction. It is divided into three sections by two fire walls extending from the basement to the roof, and there are two expansion joints on line with the fire walls, details of which are shown. Each section is served by two 600-lb. elevators and two fireproof inclosed stairways.

Wilson rolling steel doors are provided on the first floor for openings in nearly every bay on both sides of the building. The basement is waterproofed by the membrane method, using four-ply waterproofing felt.

The building and the special equipment were designed and constructed by the John W. Cowper Co., Inc., engineers and contractors, of Buffalo, N. Y., of which L. N. Harding is chief engineer.


13" Brick Curtain Wall
Uniformly Distributed Load = 50690 lb.
4th Floor, El. 50.34
3rd Stirrups
BENDING MOMENT DIAGRAM
Concentrated
Distributed
SHEAR DIAGRAM
Concentrated Load
Brickwork 83 sq. ft. x 130 = 10790 lb.
Spandrel Beam 39 cu. ft. x 150 = 5850 lb.
Sash 87 sq. ft. x 7 = 609 lb.
17249 lb. x 8.9 = 153516
Distributed Loads
(Area 149 sq. ft.)
Slab 60 lb. sq. ft.
Live Load 250 lb. " "
310 x 149 = 46190 lb.
Girder 30 cu. ft. x 150 = 4500 lb. 8.3
50690 lb. x 8.3 / 2 = 210364
Total Bending Moment = 363880 ft.-lb.
= 4,366,560 in.-lb.
Resisting Moment, Method of Transformed Sections fs = 16000 fc = 650 n = 15
The Transformed Area of Tensile Steel is, nAs = 15 x 8.86 = 132.9
And for the Compressive Steel is, nA's = 15 x 7.59 = 113.9
Equating the Statical Moments of Tensile and Compressive Areas about the Neutral Axis using the Transformed Sections
20y²/2 + 113.9 (y - 2½) = 132.9 (36.5 - y). y = 13.5 d - y = 23"
nIs' = 15 x 7.59 x (11)² = 13,776
nIs = 15 x 8.86 x (23)² = 70,304
Ic = 20 x (13.5)³ x 1/3 = 16,400
I = Ic + nIs + nIs' = 100,460 (Mom. Inertia)
Mc = fc I / y = 650 x 100480 / 13.5 = 4,840,000 in.-lb.
Ms = fs I / n(d-y) = 16000 x 100480 / 15 x 23 = 4,660,000 " "
As = 8.86
Neutral Axis
As = 7.59
Section of Cantilever Girder at Support
Gross Unit Shear at Support = 67939 / 20 x 36.5 = 93 lb. sq. in.
Gross Unit Shear at End = 17249 / 20 x 21.5 = 40 lb. sq. in.
S = Area x f x d / V = 2a x d x 0.4416 x 16000 / V = 9274 d / V
a = Area of Stirrup sq. in. - f = 16000 lb. sq. in. - V = Total Shear lb.
S = Spacing of Stirrups, Inches.

HOW ENGINEER DESIGNED CANTILEVER GIRDER



DETAILS OF CANTILEVER GIRDERS ON SCHOELLKOPF WAREHOUSE

Screw Spikes Unsatisfactory on Pennsylvania Lines

Committee Finds They Loosen Under Rail Movements as Drive Spikes Do, and Afford No Gain in Efficiency or Economy

SCREW spikes as rail fastenings are unsatisfactory and costly; they effect no reduction in track maintenance expense, and they have no advantage over the common drive spike in safety, efficiency or economy. This statement summarizes the conclusions of a report made by a committee of seven engineers of the Pennsylvania railroad system, and based on nine years of experience and observation. This report is printed in full in the *Bulletin* of the American Railway Engineering Association for October, 1917.

The trials were made on two heavy-traffic sections of main line carrying 140,000 tons and 53,000 tons daily.

This report is both unfavorable to the screw spike and favorable to the drive spike. For many years there has been a very general opinion that the latter is not adapted to track carrying heavy traffic, and that on the other hand the screw spike not only is efficient as a fastening but also effects a material improvement in safety and ultimate economy. The comr..ittee's report is directly contradictory of these views.

Screw Spikes Work Loose

One defect attributed to the screw spike is that it works loose in the tie, being pulled vertically under the influence of track forces in spite of the positive hold in the wood which is afforded by the screw thread. Screw spikes are said to have been found with their heads ¼ to ½ in. above the rail base, very much as in the common experience with drive spikes. In fact, the report says that the screw spike is less reliable than the drive spike. While the former was found to hold better at first, owing to its greater initial resistance to extraction, it became entirely loose under continued raising by the undulating motion of the rail. On the other hand, the drive spike under similar circumstances still retained a considerable part of its holding power. "Throughout this experiment, as elsewhere," states the committee, "it has been evident that there is no danger to traffic from failure of ordinary nail spikes either by shearing or extraction."

Resetting and making secure the loose screw spikes was the next point considered. When some of them became so loose that they could be extracted by hand several devices for securing the spikes were investigated, and a trial was given the Lakhovsky split lining. This is inserted in the hole and the spike is then screwed into it. It did not prove effective, as the spikes worked loose, the friction between the metal sleeve and spike being insufficient to prevent the latter from turning. The same objection led to discarding the Tenax lining (*Engineering News*, Oct. 19, 1916, p. 727) and to the decision not to apply the Thiollier lining, especially as the latter cannot be applied to track in service.

Hardwood plugs to receive the screws were also tried, in accordance with French practice, but the spikes soon became loose, and in tests the plugs were partly pulled out also. Trial of the Collet hollow hardwood plug, screwed into the tie, was not considered advisable, on account of the injury which would be done to the tie by boring holes of the large diameter required for these plugs.

In some of the experiments the screw spikes were used with steel clips resting on the rail. It was found that if tieplates are not used the cutting of the tie by the rail will permit the rail to slip under the clip. It is pointed out that if splice bars must be slotted to permit the use of clips, these slots should be semicircular, as large rectangular slots weaken the bars and may lead to breakage. Pads of cow-hair felt beneath the tieplates have proved valueless as a protection to the ties, since with heavy traffic the pads are squeezed out from under the tieplates.

First and Maintenance Cost

In first cost and maintenance cost the screw spike made an unfavorable showing in the Pennsylvania experiments. For ties, tieplates and rail fastenings on 1000 ft. of track the cost was $1044 with drive spikes and $1782 with screw spikes, the latter thus costing 71% more than the former. It is in track maintenance that the screw spike is generally supposed to show its advantage, but here the average annual maintenance cost was $338 and $593, respectively, or an increase of 75% for the screw-spike track. On heavy-traffic lines tieplates can be omitted only on tangents. Where they were not used the first cost was $812 and $1087, while the maintenance cost was $309 and $396—excesses of 33% and 30% for the screw spikes. As to repairs of track damaged by derailment, it is estimated that the time would be 60% greater if screw spikes were used, even if ties ready bored were available.

Unprecedented Ice Conditions on the Ohio River

The unusually severe winter has produced ice conditions on the Ohio River worse than ever before recorded. During recent weeks ice packs have caused local floods and in moving have carried away barges and other river craft. Col. Lansing H. Beach, of the U. S. Engineer Office, Cincinnati, states the conditions as follows:

"The records of the Government since the establishment of the Weather Bureau show nothing approaching the conditions which have prevailed this winter. The records of localities or recollection of individuals or traditions tell of nothing approaching in severity the conditions which have prevailed on the Ohio and its tributaries since the first part of December. The Tennessee River has ordinarily been regarded as the most excellent and safe winter harbor for vessels from the upper Mississippi, and the Kentucky and Green Rivers have been used for this purpose by Ohio River craft. Engineering work has been interrupted on the Tennessee by ice for the past two months, and the ice which swept out of that stream in the latter part of January is the only instance known of such occurrence on that stream. The Ohio has been solidly choked with ice from Pittsburgh to Cairo, a condition which it is known has not prevailed on that stream for more than 125 years. The Mississippi has been frozen over in places as far south as Vicksburg. The conditions are so abnormal that there is no reason to expect that they will occur again within the memory of any man now living."

Pumping Station Addition Built Under Difficulties

Knoxville Puts Temporary 15,000,000-Gallon High Duty Pump on Steep Hillside Between Boiler House and Tracks

By John W. Hill
Consulting Engineer, Cincinnati, Ohio.

URGENT need for an immediate increase in pumping capacity compelled Knoxville, Tenn., to install a 15,000,000-gal. high-duty pumping engine at its old pumping station, although the city expects within a few years to abandon this station. The extension of the old station is being made under unfavorable conditions of site unparalleled in the writer's experience with the installation of large temporary pumping plants. The work is all the more notable because when the new station is built there will be no salvage on the pump pit and the engine house extension, which are the more costly of the new work.

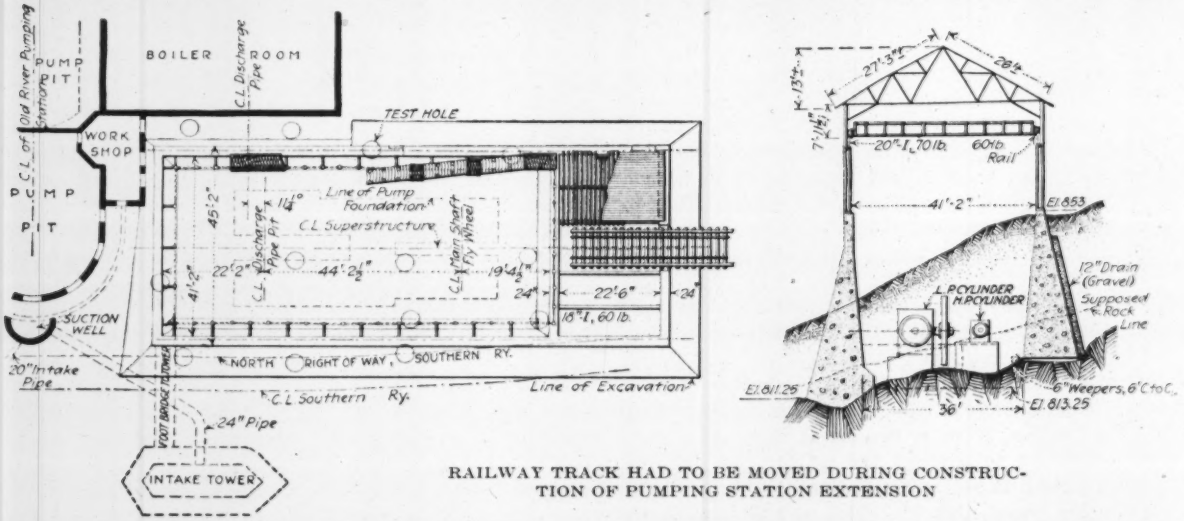
The existing pumping station at Knoxville is located on the right bank of the Tennessee River. At this point the river bank rises 97 ft. from low water to East Front St., a horizontal distance of only 126 ft. Within this distance the old engine and boiler houses are placed, with the belt line of the Southern Railway between them and the intake tower. The addition to the engine house had to be placed between the boiler house and the river. This required a temporary relocation of several hundred feet of railway track, the location of which is shown by the illustrations.

The over-all dimensions of the new pump pit, not including space for the suction pipe, air pump and condenser, are 25½ x 57½ ft. The inside dimensions of the pump pit are 36 x 80 ft. at the level of the engine room sub-floor (El. 817.5) and 41½ x 85¾ ft. at the top or ground line (El. 853). The total space between the boiler house and the railway right of way is about 55 ft. The outer wall of the pump was designed as a retaining wall below bank level (El. 830) and as a dam above that level. The inner wall was designed as a retaining wall to resist the hillside thrust. Excavation disclosed the fact that the old boiler house wall, on the river side, rested on clay and silt, instead of rock, as had been supposed. This necessitated 22 to 29 ft. of underpinning as a part of the new work. Low water is at El. 809.

The new engine pit has been extended 24½ ft. beyond the length already mentioned to provide space for bringing the engine parts in by rail. The overhead traveling crane which forms a part of the new equipment will run out over the extension. When the engine has been erected a floor will be built at the railway track level. The room thus formed will be used as a shop and store room. When the time comes to dismantle the pumping station the floor will be removed and the engine parts loaded by the crane onto cars for removal to the new up-river station.

KNOXVILLE PUMPING STATION EXTENSION WAS BUILT IN CLOSE QUARTERS

J. G. Crumbliss is commissioner of parks and property. A. S. Birdsong is superintendent of water-works.



RAILWAY TRACK HAD TO BE MOVED DURING CONSTRUCTION OF PUMPING STATION EXTENSION

Summers Hinshaw is resident construction engineer and John W. Hill & Sons, Cincinnati, Ohio, are consulting engineers for the work. The new pumping engine is being supplied by the Hooven, Owens, Rentschler Co., Hamilton, Ohio, under a contract bearing date of Dec. 8, 1916.

How to Proportion Unsymmetrical Concrete Arches

By Combining Halves of Two Symmetrical Arches of Different Spans Formula for Dimensions of Ring Is Developed

BY JOSEPH P. SCHWADA
Engineering Department, Railroad Commission of Wisconsin, Madison

ONE of the steps in the design of an unsymmetrical concrete arch is the proportioning of the arch ring. This consists of the determination of the position of the crown with respect to the springing lines, and the selection of a proper crown thickness, the curvature of the arch axis and the thickness of the arch ring from the crown to the springing lines. The writer has developed an empirical method of determining these dimensions.

An unsymmetrical arch ring may properly be considered as made up of half-spans of unequal symmetrical arches, selected so that when treated as the half-spans of symmetrical arches, the crown thrusts for dead-load

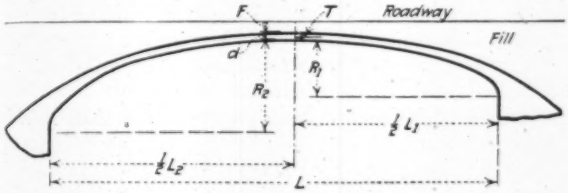


FIG. 1. OUTLINE OF UNSYMMETRICAL ARCH

only will be equal. The position of the crown, then, will be at the point of zero shear and the crown thickness, curvature of the arch axis and the thickness of the arch ring may be obtained as for symmetrical arches.

Considering now in detail the determination of the position of the crown, in the sketch of the unsymmetrical arch, Fig. 1, let L equal span of arch intrados; $\frac{1}{2} L_1$, length of shorter segment of arch intrados; $\frac{1}{2} L_2$, length of longer segment of arch intrados; R_1, rise of shorter segment of arch intrados; R_2, rise of longer segment of arch intrados; d, crown depth of ring, and F, depth of fill at crown (not including track or ballast)—all in feet. Also B, weight of track and ballast or pavement, in pounds per square foot, and T, crown thrust, for dead load only, in pounds.

If the segments of the unsymmetrical arch ring in Fig. 1 be considered the half-spans of symmetrical arches, the arches are as shown in Fig. 2. Here T_1 and T_2 represent the crown thrust for dead load only and are assumed to be applied at the arch axis. With thrust T_1 made equal to thrust T_2, the position of the crown or the lengths of the segments $\frac{1}{2} L_1$ and $\frac{1}{2} L_2$ may be obtained.

An empirical expression for the crown thrust of symmetrical arches, in terms of the rise and span, is derived in an article, "New Formula for Crown Thickness of Arches," *Engineering News*, Nov. 9, 1916, p. 880. The expression for thrust, for dead load only, is there shown to be

$$T = \frac{2.5L^2}{R - d}\left[\frac{B}{20} + R + 8d + 6F\right]$$

where in addition to the notation used above R = rise of arch intrados, in feet.

Applying the expression for thrust to the arches in Fig. 2,

$$T_1 = \frac{2.5L_1^2}{R_1 - d}\left[\frac{B}{20} + R_1 + 8d + 6F\right]$$

and

$$T_2 = \frac{2.5L_2^2}{R_2 - d}\left[\frac{B}{20} + R_2 + 8d + 6F\right]$$

Equating the crown thrusts T_1 and T_2,

$$L_1^2\left[\frac{B}{20} + R_1 + 8d + 6F\right]\frac{2.5}{R_1 - d} = L_2^2\left[\frac{B}{20} + R_2 + 8d + 6F\right]\frac{2.5}{R_2 - d}$$

For convenience let

$$\left[\frac{B}{20} + R_1 + 8d + 6F\right]\frac{2.5}{R_1 - d} = D$$

and

$$\left[\frac{B}{20} + R_2 + 8d + 6F\right]\frac{2.5}{R_2 - d} = C$$

Then

$$L_2^2 = L_1^2 D/C.$$

Also from Fig. 1,

$$L_2 = 2L - L_1$$

Solving these equations simultaneously, there is obtained the expression

$$\tfrac{1}{2}L_1 = \frac{L}{1 + \sqrt{D/C}}$$

where $\frac{1}{2} L_1$ represents the length of the shorter segment of the unsymmetrical arch of span L in Fig. 1.

In the foregoing derivation the factor d, thickness of crown, enters into the values of C and D and is an unknown quantity. However, from the span length and high rise of the unsymmetrical arch, it is possible to determine an approximate value of crown depth d, as for

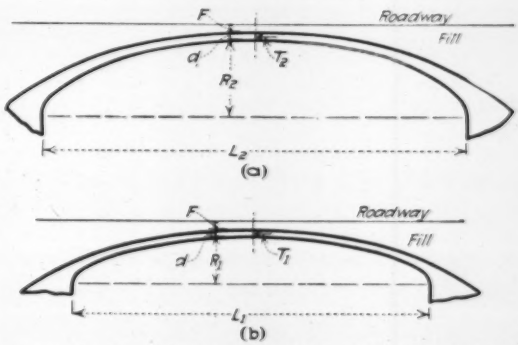


FIG. 2. TWO SYMMETRICAL ARCHES WHOSE HALVES MAKE UP UNSYMMETRICAL ARCH

symmetrical arches. Knowing that the span length of the equivalent symmetrical arch with the high rise is greater than the span length of the unsymmetrical arch, a close approximation of the crown depth may be made, by assuming the span length to be 1.1 times the given span. With the value of L_1 determined, the span length assumed to obtain the value of d may be checked.

To illustrate the application of the method to a highway arch assume: Span, 80 ft.; rise of longer segment R_2, 16 ft.; rise of shorter segment R_1, 10 ft.; no pavement; fill over the crown, 2 ft.; live-load, 200 lb. per sq.ft. According to the formula for crown thickness, in the article previously referred to, the crown thickness

for a symmetrical arch with span equal to 1.1 times 80 or 88 ft., and rise equal to $R_2 = 16$ ft., stress $f = 550$ lb. per sq.in. and with given conditions of fill and loading, is about 15 in. or 1.25 ft. Then

$$C = [0 + 16 + 10 + 12]\frac{2.5}{16 - 1.25} = 6.44$$

$$D = [0 + 10 + 10 + 12]\frac{2.5}{10 - 1.25} = 9.14$$

$$\frac{D}{C} = \frac{9.14}{6.44} = 1.42 \text{ and } \tfrac{1}{2}L_1 = \frac{80}{1 + 1.42} = 36.6\ ft.$$

The longer segment $\frac{1}{2}L_2 = 80.0 - 36.6 = 43.4$ ft.

The proper crown thickness for the unsymmetrical arch ring may now be definitely determined by considering the segments with the respective rises to be the half-span of symmetrical arches. With span L_2 86.8 ft. and R_2 16 ft., the crown thickness is 15 in. With span L_1 73.2 ft., and rise R_1 10 ft., the crown thickness is 14.8 in. A thickness of 15 in. will be used in the tentative design of the arch in Fig. 3.

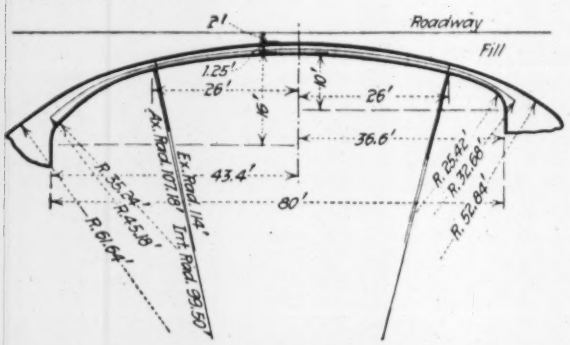


FIG. 3. DIMENSIONS OF UNSYMMETRICAL ARCH AS DERIVED FROM FORMULA

The curvature of the arch axis and the thickness of the arch ring from the crown to the springing lines is now selected by treating each segment of the unsymmetrical arch ring independently as the half-span of a symmetrical arch. The vertical thickness of the ring at the springing lines is made equal to about three times the crown thickness and the arch axis is made to coincide with the dead-load pressure line. The central portion of the arch ring is made symmetrical. In drawing in the pressure line, it is assumed that the shear at the crown is zero. This is not mathematically correct, because the formula for the crown thrust is empirical. The shear obtained at the crown, however, will not materially change the position of the dead-load pressure line used in drawing up the tentative arch ring.

COMPARISON OF CROWN THRUSTS—DEAD LOAD ONLY

Arch	Method	Crown Thrust, Lb.
Unsymmetrical	Elastic Theory	51,810
Shorter Symmetrical	Elastic Theory	51,100
Longer Symmetrical	Elastic Theory	52,800
Both Symmetrical	Empirical Formula	51,500

That the general assumptions made in the derivation of the formula for the lengths of the segments are reasonable is shown by a comparison in the accompanying table between the crown thrust for the unsymmetrical arch in Fig. 3, determined according to the elastic theory, and the crown thrust for the symmetrical arches with half-spans equal to the segments of the unsymmetrical arch, determined according to both the empirical formula and the elastic theory.

The shear at the crown for the unsymmetrical arch is +235 lb. and the bending moment at the crown is —2485 foot-pounds.

If the method proposed is applied to arches differing considerably from the type of arch adopted in deriving the expression for the crown thrust, and the pressure line is found to be unsatisfactory, the tentative design should be modified. The shear obtained at the crown will determine the change to be made in the length of the segments of the unsymmetrical arch, in order to place the crown at the point of zero shear.

Plane-Table Surveys Advocated for Drainage Work

Direct Plotting on Drafting Table in the Field is Great Advantage Over Plotting From Field Notes in the Office

IN MAKING surveys for drainage projects the plane-table system of combining surveys and direct plotting in the field is superior to the system of transit survey followed by office plotting from notes, according to a paper read by L. H. Williams, Quincy, Ill., at the annual meeting of the Illinois Society of Engineers.

For the transit method of survey the party will consist ordinarily of recorder, transitman and one rodman, but where the rodman has to walk long distances between shots it is often advantageous to have two men. So far as the transitman is concerned, there is little difficulty in taking instrument readings rapidly enough to keep up with two rodmen. The recorder is the governor of the speed of the party, for his duty requires the noting of all instrument readings such as horizontal angles and foresight for elevation, besides the task of giving detail descriptions and making sketches sufficient to enable the office draftsmen to plot the results.

Necessity of having sufficient data is a point wherein the transitman may fail in his efforts to gain speed, and this may leave large areas in question as to the correct placing and joining of contours. It is not a matter of knowledge as to the many horizontal angles which may be either incorrectly observed or recorded and upon which there is no check either in field or office. No control point closed upon can give a check as to azimuth of distance in the circuit, and thus an error may be carried through an entire day's work.

Field work must be accurate, concise and complete in every detail to be of significance to the draftsman. If the transitman is to do the drafting, he must do it very soon after he has left the field or he will not be able to rely on his memory for a true portrayal of positions or form. Some transit parties are accompanied by an assistant with a sketch board, but this is an added cost and is the same as having two recorders. The transit method involves the transcribing of one man's notes by another who gets his conception of the topography from the notes alone.

With the plane table method there is literally a drafting office in the field. The outfit consists of an instrument by which points are located in the field graphically, the map being fastened to a board or table top supported by a tripod. The instrument or alidade has a flat rectangular base which rests on the map and may be moved to any desired position. One side of this base

has a ruling edge and is parallel to the line of sight, which permits the immediate drafting of the direction of any points desired.

Perhaps the main objection to this method is that the map is necessarily exposed to the weather. But the source of error due to distortion or shrinking and expanding of the paper with the temperature and humidity is easily eliminated by using a paper double mounted on linen, with the grain of the papers at right angles. Seasoning the paper, by keeping it in stock for some time and exposing it to changeable temperatures, will help to prevent changes in the field.

Scaling the distance represented between the rectangular coördinates plotted on the maps constitutes the best check for accuracy. For example, coördinates plotted five inches apart on a scale of 600 ft. to the inch would give 3000 ft. on each axis. If the tested distance is found to be 2995, there is an error of paper shrinkage of 5 ft. in 3000, or 1 ft. in 600, and the corresponding correction can be applied to plotting of instrument readings. Since most distances for lengths of courses for table stations and side shots are more nearly in the neighborhood of 400 or 500 ft. this correction can be neglected. The same applies to the correction of $(f + c)$ instrument equation.

The plane table is not mathematically an exact instrument so far as the readings are taken when the alidade in many instances is not precisely centered over the position of the plotted station occupied. The element of accuracy of any map is correct only to the extent that the scale will permit of drafting and plotting, regardless of the precision of field measurements.

Regarding the comparison of the plotting of transit notes in the office with that of plane table data in the field, the former has many devices which tend for speed and accuracy, such as various forms of protractors with attachments and radial arms. These cannot supplant the method of scaling the desired distance with the instrument set on the line of sight, as in the plane table method. This forms the foundation of the advantage the plane table has over any other method, for with the country before him and a rodman ready to send to any point desired, the engineer can sketch in the contour at once, thus eliminating time spent in taking unnecessary readings. He does not have to burden his memory with detail, and has no conglomeration of notes to translate in order to obtain the true conception of topographic form.

Plane table work requires an instrument man and two rodmen. No recorder is needed on drainage surveys. The only records are level notes, fore and back sights of turning points, and their distances. The side shots can be made mentally with the H. I. in sight on the cover sheet of the map. Side shots are taken only to the nearest tenth, and the result is marked on the plotted position on the map, using the dot denoting the station as decimal point.

Comparison of time spent in the field work may seem to give the plane table a disadvantage, considering the portion spent in sketching contours and drafting the cadastral features. However, with this part accomplished the work is completed and ready for inking or tracing. With other methods the office force must spend even a greater length of time for the same drafting, for they must work from descriptive notes. Even so, with skilled men in both positions, the number of acres covered in a day by plane table methods, completing the work as they go, has in many cases far surpassed the acreage over which a trained transit party has merely taken notes.

As to the scale for maps of drainage surveys, Mr. Williams advocated 400, 500 or 600 ft. to the inch. Maps on these scales can show topographic and hydrographic forms in proper relief, and enable the engineer to make calculations for estimates and designs for construction works.

Massachusetts May Standardize Salaries

A SPECIAL recess committee on standarization of salaries of state employees has made its report to the Massachusetts legislature. The plan presented is based on equal salaries for the same classes of work in practically all the branches of the state's public service. It would apply to all classes from judges to laborers, including hundreds of men in the engineering, inspection and other technical departments.

The proposed salary range for engineering and some other technical classes of employees is as follows:

Engineer, Grade	I	Engineering assistant	$600–$840–$1,020†
	II*	Junior engineer	$1,080–$1,800‡
	III*	Assistant engineer	$1 800–$2,820
	IV*	Senior assistant engineer	$2,820–$3,600
	V	Chief engineer	$3,900–$6,000
		Laboratory assistant	$480–$1,200
		Health instructor	$1,080–$1,680
		Analyst of explosives	$1,800–$2,340
		Industrial accident investigator	$1,320–$1,800
Insurance examiner,	I	Assistant examiner	$1,200–$1,800
	II	Examiner	$1,980–$2,820
	III	Chief examiner	$2,820–$3,600
		Minimum-wage examiner	$1,200–$1,560
Boiler Inspector,	I	Inspector	$1,440–$1,800
	II	Deputy chief inspector	$2,340–$2,820
		Inspector of dredging	Prevailing rate
		Inspector of dumping	Prevailing rate
		Inspector of engine, fire Prevention appliances	$900–$1,200
Fire Warden,	I	Warden	$900–$1,440
	II	Chief warden	$1,800–$2,340
Gas Meters	I	Inspector of meters	$840–$1,200
	II	Inspector and analyst of gas	$1,320–$2,340
	III	Chief of division of gas and gas meter inspector (Gas and Electric Light Commission)	$3,600–$4,000
Watershed Inspector			$840–$1,320
Smoke Abatement	I	Inspector	$1,200–$1,680
	II	Chief of smoke abatement	$1,980–$2,820
Railroad and Railway	I	Inspector steam railroads (track roadbed), (car equipment), (locomotives)	$1,440–$1,800
	II	Senior inspector	$1,980–$2,580
	III	Chief of inspection division	$3,600–$4,800
Telephone and Telegraph Inspector	I	Inspector telephone plant	$1,440–$1,980
	II	Chief of division	$3,600–$4,800

* Includes also civil, electrical, mechanical and sanitary engineers.
† Entrance rates dependent upon special character of the duties to be performed or special qualifications necessary.
‡ $1,440 is the maximum rate for transitmen who are not heads of parties.

Surface Rights Over Coal Mines Protected

A court decision at Scranton, Penn., on Jan. 8, gives extensive protection to surface property against subsidence due to mining operations. Judge O'Neill granted an injunction restraining the People's Coal Co. from mining and removing coal so as to endanger the support of streets and public highways in West Scranton. The city is held entitled to 100 ft. of lateral support on each side of the street, more or less. It is understood the case will be appealed by the coal-mine operators. The injunction carries with it a judgment in favor of the city for damages to the sewer system and streets amounting to about $29,000.

First Frost Is Never Responsible for Cracked Concrete Roadways

Damage Can Be Traced to the Freezing Which Follows a Thaw—Water-Logged Soil, Confined Between Solidly Frozen Earth and New Layer of Ice, Expands and Cracks Slabs

By J. L. Harrison
Highway Engineer

PROBABLY the most serious objection that can be raised against concrete as a surfacing for rural roads and light-traffic city streets is that as yet no method has been devised for preventing the "heaving" and cracking which is of frequent occurrence in the late winter and early spring months. If this seasonal destruction is ever to be avoided, the nature of the causative forces must be understood; for though the troubles which concrete pavements undergo seem almost universally ascribed to frost action, there is little appreciation of just what phenomena are actually covered by this term.

A consideration of certain facts, which are well known or can be easily verified by observation, will simplify the understanding of the question; and, reasoning from them, the basis of a proper design for a concrete roadway may be determined. Briefly stated, these are as follows:

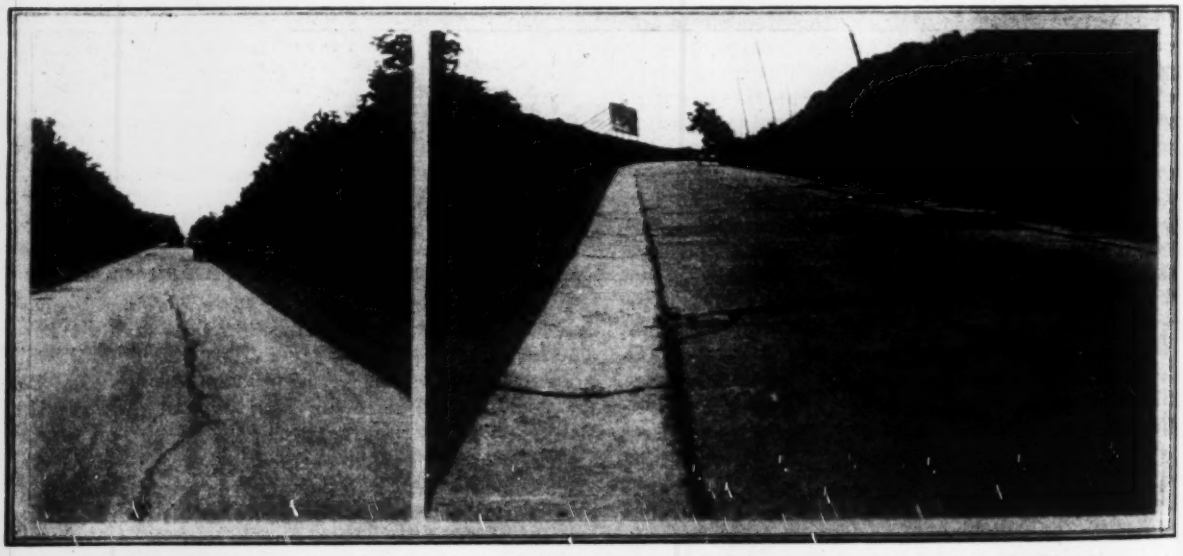
(1) Throughout the greater part of the United States the soil freezes every winter to a depth of from a few inches to as much as 4 or 5 ft.—depending, of course, upon the isothermic latitude.

(2) Pavements do not heave during the first freeze. This fact is attested by practically all engineers in charge of their maintenance. Therefore it may be concluded that such swelling as may attend the first freezing of the soil is general in its nature and of no consequence so far as its effect on hard surface pavements is concerned.

(3) After the ground has frozen, warm periods which thaw the surface occur rather frequently, this thawing process often extending to a depth greater than the thickness of the concrete surfacing of the ordinary highway, but not to the full depth to which the ground is frozen.

(4) Any snow on the ground, or any rain or snow which falls during these warm periods, is absorbed by the thawed out layer of topsoil, for the possibility of the escape of any of this moisture downward through the soil is largely, if not wholly, cut off by the still frozen ground. If this frozen layer is not at first impervious, it will rapidly become so, as any water seeping through the thawed out topsoil will freeze soon after reaching the still frozen ground. In this way it may, and in fact often does, happen that the escape of water downward is wholly cut off and that the top soil becomes extremely wet.

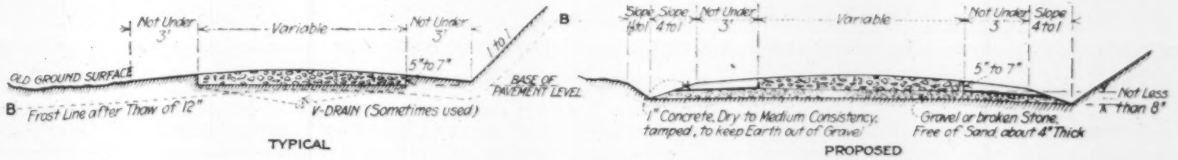
(5) During the late winter and early spring months, thaws are followed by cold periods during which the layer that was thawed out is again frozen solid. But whereas the original freezing of the ground caused no local disturbances, the freezing of a layer of wet ground on the top of a thick sheet of frozen earth will behave more like a layer of water which freezes on top of a sheet of ice. Consider the action which takes place under these circumstances. In the first place, the old sheet of ice has not melted uniformly, and therefore presents many points which project above the average



IN NEITHER CASE WAS ANY ATTEMPT MADE TO KEEP SUB-GRADE DRY, OR TO DISPOSE OF WATER SEEKING ENTRANCE FROM THE SIDE—CRACKED SLABS WERE INEVITABLE

surface. As the new ice begins to form on the layer of melted ice, its under surface is not flat and smooth, but irregular, as was the under surface of the original layer of ice. As this new layer thickens it soon comes in contact with the upward projecting portions of the original ice layer, becoming attached thereto at many points. The freezing progressing, pressure is developed. Perhaps in many cases this pressure breaks the contact between the old and new layers, but in many instances the pressure will rupture the new surface of ice and relieve itself by flowing out on top. However, the temperature of the water between the two layers of ice has fallen below freezing, due to the pressure, and therefore as soon as the new ice layer ruptures, the release water freezes before it has a chance to spread out uniformly over the upper layer of ice. It piles up in a more or less circular mass, often a number of inches higher than the general level of the top of the upper ice sheet. This phenomenon will be recalled by all who have witnessed the freezing of an inch or two of water on an old ice sheet during the skating season.

If the amount of moisture which has fallen during a warm period has saturated the layer of soil which has been thawed out if the design of the highway is such



THE CONVENTIONAL SECTION PUTS ALL TRUST IN THE STRENGTH OF THE CONCRETE—THE PROPOSED SECTION TAKES CARE OF TROUBLE AT THE SOURCE

that either capillary action or direct seepage will enable this moisture to penetrate to any thawed ground under the pavement; and if the warm period is of sufficient duration to enable this moisture to work its way under the pavement, conditions are ideal for the heaving of the pavement whenever there is a sufficiently protracted drop in the temperature. For water freezing between a thick layer of frozen ground and a hard pavement can hardly be materially different from water freezing between two ice sheets.

(6) As concrete is a poor conductor of heat, it is probable that both the thawing out of the ground and its refreezing will take place more slowly through a concrete pavement than they do through ordinary soil, especially if the soil is pretty well saturated. When there is saturation of even a small thickness of soil between a concrete pavement and a thick layer of frozen ground under the pavement, there can be no escape from heaving if the following weather is severe, for the frost action will work down in the wet shoulders faster than it will through the pavement itself, and in this way so seal the edges of the pavement that the final release of the pressure can come only by a process of rupture. But as rupture always takes place at the weakest point, it is local in its effect.

(7) That the blocks affected are not raised or fractured by any general movement of the base is usually evident from the fact that when newly "heaved," and before traffic has affected their position, it is often possible to push sticks between the blocks and the base. The writer has heard of cases where it was possible to see clear across the subgrade under concrete blocks.

(8) If the pressure is relieved by an outpouring of water only, the pavement will settle back in place when the ground thaws out in the spring. Unfortunately, however, the water often carries with it enough solid matter so that the bunch formed at the point of rupture will not completely disappear.

The writer believes that relief from heaving will involve a complete alteration of the design of the foundation for all hard surface pavements. There can be no doubt that a dry subgrade would never heave and though much attention has been given to this point, engineers have assumed that water can drain down and away in the winter just as it does in the summer; and have overlooked the fact that all subdrains, as now designed, are likely to become clogged with ice.

The designs at present used, and as here illustrated, are faulty in that they take no account of frozen subgrades. Thus if there is a thaw which has, let it be assumed, penetrated the ordinary surface soil to a depth of about a foot, the subsoil and any subdrainage system used being still frozen to a line about as B-B. Then if there is a rain or snow fall, and if the soil in the ditches and slopes is porous, water can readily seep through into the base. But as under such circumstances the larger part of any stone base as now designed is in the still frozen stratum, water that percolates into the lower and colder part of it will freeze, thus gradually closing the pores in the base. If the process is continued over a period of some days, during which there may be alternate periods of thawing and freezing, the voids in the base may become thoroughly filled with ice and consequently as inoperative for drainage purposes as the normal subsoil.

In this connection it might be remarked that whatever success has attended the use of the heavy gravel and stone drain under concrete pavements is easily explained as having been wholly due to the fact that such structures act as a reservoir into which the leakage from the ditches and oversaturated shoulders can be poured, and that as long as the leakage does not exceed this storage capacity the pavement is safe from heaving. But when the soil or broken stone below B-B has been converted into a solid mass by the filling of all of the voids with ice, and the leakage has continued until the volume between B-B and the bottom of the pavement has become saturated, then a drop in temperature results in the lifting and breaking up of the overlying slabs.

To avoid these harmful results it is necessary to raise the concrete pavement or lower the ditches such a distance that the saturation of the top layer of soil adjacent to the road will not result in the saturation of

any porous or thawed out material under the pavement itself. This may be done by providing a drainage system so located that it will surely function whenever any part of the ground under the pavement thaws. This provision establishes four requirements:

(1) The ditches should be placed far enough below the bottom of the concrete pavement that there can never be direct leakage from the ditches into any part of the subgrade which might thaw out during winter.

(2) The base should be so constructed that any leakage through the shoulders or through cracks in the pavement can drain into the ditches at once.

(3) The thickness of the sub-base should always be great enough that the depth of the base plus the depth of the pavement will at least equal the total depth to which winter thaws are likely to reach.

(4) All side ditches and all lateral drainage ditches must be so sloped that surface water will be thoroughly and promptly drawn off.

Improvements usually cost something. However, in this case, as it should usually be sufficient to place only about 6 in. of stone under a concrete pavement; and as a foot of stone is now used in many instances, the cost of the completed pavement ought not to be much increased. As little as 4 in. of stone, properly placed, will be enough for a base in many regions.

The necessity of raising the subgrade or lowering the ditches enough to give at least 8 in. clear distance between the bottom of the ditch and the bottom of the concrete slabs will be open to some objection where pavements are to be built within the corporate limits of towns and cities. This provision will also involve some expense. However, in answer to these objections it should be pointed out that whenever the roofed area approaches 100%, as it does even in the residence districts of many large cities, and the sewer systems are nearly complete, heaving has never been enough of a problem to cause trouble. Where the conditions fall between those prevailing in the city and those in the open country, the engineers in charge should make such provisions for winter drainage as seem necessary—a matter which it will not be hard to do when it is fully appreciated that winter drainage problems are distinctly different from summer drainage problems.

Price of Export Cement High

According to a special statement of the division of statistics of the Bureau of Foreign and Domestic Commerce, the 185,592 barrels of cement exported from this country in October last was valued at $388,724, or about $2.10 per barrel. The price, f.o.b. New York on Nov. 1, without containers was $1.82, it being assumed that a large share of the material was shipped from that port. On the basis of the statement, Brazil, the Panama Canal, Cuba, and the Argentine Republic, in the order named, are the principal consumers of American cement, being the only ones receiving more than 10,000 bbls. each, and taking between them nearly half the total. All of the cement shipped during the month went to the Americas, and the prices indicated ranged from about $1.70 per bbl. for that sent to Panama to about $2.70 for that sent into Mexico. The 55,000 bbls. bought by Brazil and 20,000 bbls. sent to the Argentine were apparently sold at the average price given above.

Railway Bridge Live Load and Impact To Be Studied in India

AN OFFICIAL committee of railway bridge engineers in India, convened by the Government Railway Board, recently began the formulation of new live load standards for Indian railways. The four gages in use there, 5½-ft., meter, 30 in. and 24 in., call for four separate standards. Present standards, existing for a number of years, are believed to be no longer ample.

A provisional recommendation has been made by the committee that a train loading of 4000 lb. per foot of track for 5½ ft. gage and 2800 lb. per foot of track for meter gage be used. No agreement has yet been reached on the type or axle loading of a standard engine for bridge design purposes.

Allowable unit stresses, the committee recommends, should be kept at the present standards, which for steel are 18,000 lb. per sq.in. for tension and compression, 11,200 lb. for shear, and 24,600 lb. for bearing. These are assumed to be based on a tensile elastic limit of about 36,000 lb. per sq.in., and the principle is held that "ordinary stresses which are readily computable should be limited to one-half the elastic limit." It is considered that these unit stresses allow a margin for accidental defects in material and workmanship, corrosion, temperature, stress, and other stresses not readily computable, but do not allow a margin that will cover large secondary stresses in badly designed structures.

The committee is planning in its future work to prepare specifications for bridge design "which will draw attention to the principal defects of badly designed girders which cause excessive secondary stresses."

The committee was requested also to consider impact. So far the Pencoyd formula, $300/(300 + L)$ has been in use, but it was recently proposed to substitute the new American Railway Engineering Association formula, $30{,}000/(30{,}000 + L^2)$. The fact that the new formula gives reduced impact allowances on long spans, but that few of the experiments on which it is founded were made on long spans, was one of the factors that led the committee to retain the older formula.

The members also agreed that experiments on which an impact formula for Indian railways should be based ought to be made in India, and such investigations have been recommended to the Government. As a preliminary, the question of the best type of extensometer and deflectometer is to be looked into.

The question came up whether different impact allowances should be made for each of the four gages. The chief fact of influence is that on the narrow gages only moderate speed can be reached. However, since certain impact experiments have shown that the dynamic effect of a train may be greater at 25 miles per hour than at higher speed, the committee—pending the tests which it purposes to have made—considers that the Pencoyd formula should be applied to narrow-gage railway bridges as well as to the meter gage and 5½-ft. gage.

The committee consists of G. Richards, chief engineer of the railway board, chairman; A. A. Biggs, chief engineer, Madras & Southern Mahratta Ry.; C. W. Anderson, engineer of bridges, Bengal-Nagpur Ry.; H. S. Sales, bridge engineer, North Western Ry.; and T. C. Hood, Great Indian Peninsula Ry.

French Quarries Inspected by U. S. Engineers

In 900-Mile Automobile Trip Two Officers Find Hand Labor the Prevailing Method of Operation—Average Daily Output 1 to 1½ Metric Tons Per Man

By Robert K. Tomlin, Jr.
Engineering News-Record War Correspondent in France

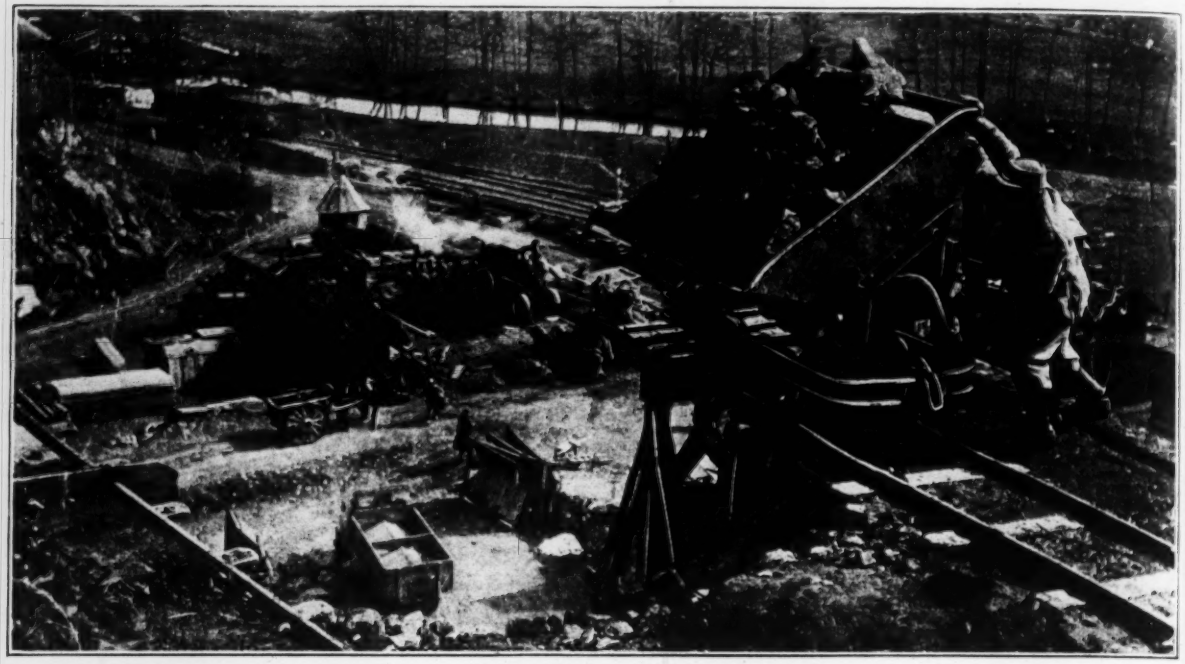
With up-to-date mechanical equipment installed in those French quarries which will be worked ultimately by American forces to supply crushed rock for military road building and track ballast, it is hoped that substantial increases in the present output per man per day may be made. Under the present methods of operation by the French the average daily output per man is from 1 to 1½ metric tons. In order to get first-hand information regarding French quarry resources in the territory which our troops will occupy, the manager of roads, American Expeditionary Force, delegated two of his officers to make an inspection trip. The engineers, one formerly in the quarry business on the Pacific coast, the other a former representative of a large machinery manufacturing company, have just completed their mission, which involved a 900-mile automobile journey, and have told me in a general way the results of their observations.

Almost the first thing an engineer learns in France is that mechanical equipment of any kind, except in the plants now working on munitions and other war material, is about as difficult to get as white bread, or telephone service which has even the semblance of efficiency. And so, while one can make all sorts of estimates of quarry output with mechanical plant, the first real big job is to land the machinery and the men to operate it safely on this side of the Atlantic. Then the output will very largely take care of itself. With regard to the French quarries, however, I am told that with a few exceptions hand labor has been the chief reliance ever since the war began. No local quarries are being worked by American forces at this writing, and until some definite arrangement is made with the French for the taking over of quarries in certain territory by our men, very little can be said on the subject.

The labor used in the French quarries which were visited by the two engineers of the road department of our army is to a large extent African, although some French workers are used. Sometimes an Ingersoll-Rand compressor and jackhamer drills were in evidence, but for the most part the drilling is done by hand. I was told that the rate of drilling was from 1 to 1½ meters per man daily. The rock is a soft limestone, with layers of clay intervening. The quarries as a rule are worked in low faces, and drill holes are commonly

French official pictures

IN THE FRENCH METHOD OF QUARRY OPERATION HAND LABOR HAS BEEN USED TO A LARGE EXTENT

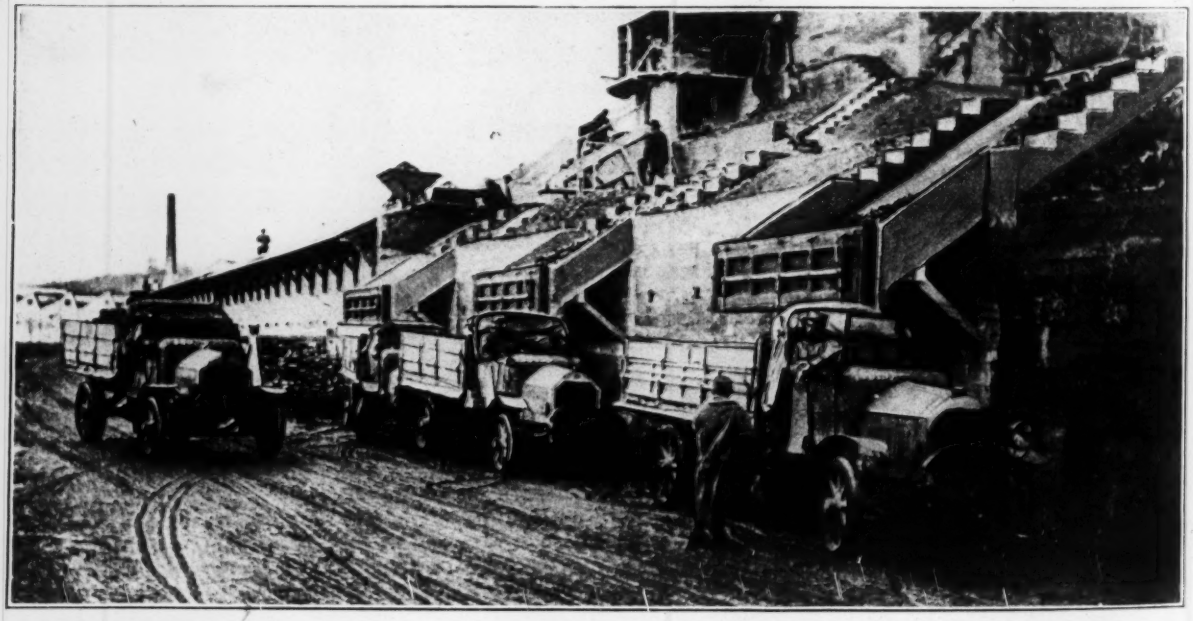


French official pictures

DELIVERING QUARRY OUTPUT TO CRUSHERS—NOTE GABLED SHAPE OF MOTOR-TRUCK BOTTOM IN FOREGROUND—DUMPING BODIES ON TRUCKS VERY UNUSUAL

about 8 ft. deep. After being broken out by explosives, the rock is fed into small jaw crushers, or else reduced in size by hand tools. The rock is screened in inclined grizzlies with ½-in. spacing, and for breaking the large chunks one of the prevailing implements is a small hammer on the end of what is described as a "bamboo cane." Such mechanical crushers as were observed were run with any kind of power available—sometimes steam, sometimes gasoline, sometimes electricity.

Most of the loading into cars is hand work, and a radical difference between these wartime quarries and the kind an American engineer is accustomed to is the absence of storage bins. This lack of bins was noted throughout their trip by the two American engineer officers. All rock storage of the smaller quarries is either in stockpiles on the ground or in the cars themselves. Two reasons are advanced for this practice. In the first place, lumber in France is pretty much



French official pictures

AT THIS QUARRY MECHANICAL PLANT IS MORE IN EVIDENCE—NOTE LOADING OF TRUCKS FROM CHUTES

of a luxury these days, and in the second, a group of storage bins might tempt an enemy airman to a test of his markmanship with high-explosive bombs. As a means of increasing output in any quarries which American forces may operate, it is the intention to dispense with hand loading of cars to as great an extent as possible. Much of the crushed rock, I learn, is transported by means of the French system of canals in boatloads of 250 metric tons each.

There is one French quarry of large size where trap-rock is procured and where crushers and mechanical devices of various kinds are more in evidence than at the smaller limestone quarries. This big quarry is in the form of a large "glory hole" which is worked in six benches each 25 ft. high. The stone, however, is lowered in cars on gravity planes to the tunnel level instead of being drawn through chutes. The output of this quarry is 600 tons a day with a force of about 400 men. Steam-driven air compressors, tripod drills, jackhamers and mechanical chain haulage through a long tunnel are features of these works. The storage, however, is principally on the ground or in the small wooden quarry cars, of which there are about 1500. This is the biggest of the French quarries, and trap rock is shipped from it by rail to points as far distant as 150 miles.

From my conversation with the engineers who inspected the French quarries, I infer that our chief task in procuring crushed rock for road construction and maintenance will be to revise the operating system now in force with a view to securing greater output with fewer men. This will mean the installation of up-to-date machinery, the provision of elevated storage capacity, and the speeding up of car loading.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Public Work of One Engineering Society During the Past Year

"TAKING organized action on affairs of public policy is generally regarded as a new departure for engineers. It is not new to the engineers of Nashville," said Hunter Macdonald, president of the Engineering Association of Nashville, in his address to that society on Jan. 4. "While it is true that in the not very distant past the generally accepted object of engineering organization was the advancement of engineering knowledge and practice, the history of this organization is replete with instances of having forcibly injected itself into public affairs when convinced that our city government was in danger of adopting some policy not in accord with good engineering and flagrantly against the public interest."

Carrying out these remarks, Mr. Macdonald gave a summary of the public service work done by the Engineering Association of the South and then reviewed the work done during the past year by its successor, the Engineering Association of Nashville. The earlier parts of this record include some notable items of society activity: Opposing and defeating a dangerous water filtration contract in 1904; advising the city on methods to pursue in securing a purified water supply, at the request of the city officials, in 1907; work in park administration, carricd on continuously during a number of years; joint work with the fire commissioner and the building inspector in framing a new building law subsequently enacted; assistance in organizing smoke abatement work; study of city government leading to report on the impracticability of securing efficient administration under the present so-called commission form of government and pointing out how the charter should be amended for efficient administration; coöperation with other public bodies in a central health board, including propaganda for sewerage extension, and finally the great undertaking carried out a year ago in studying and promoting the Muscle Shoals power project as part of the government nitrate plant proposal.

The past year brought many more opportunities to the Nashville association, and a large total of public service work was accomplished. An unusual feature is participation in routine administrative work of the city. Continuous contact through the central health board with city sanitation, and contact with the building department through a committee, are two examples. A related item of service was the nomination of a smoke inspector, at the request of the mayor; the man named by the committee on smoke abatement was appointed.

Most of the other work was of the character of investigation, in some cases combined with active promotion of the resulting recommendations.

Continuation of earlier work of the society on the study of city sanitation and sewer extension culminated in the passage of a bond issue by vote of the citizens, so that construction work on sewer extension will soon be under way. The society helped actively in bringing about this favorable result. A committee joined hands with the county authorities in securing highway legislation for the Federal aid work; these efforts were partially successful and more is to be done in the same direction at the next session of the state legislature.

A special committee studied the situation of the waterworks and electric light plant, and drew public attention to the importance of improving the operation of both plants. This work apparently has not yet led to remedial action. Another committee studied traffic conditions in Nashville's narrow streets, and assisted in bringing about a one-way traffic arrangement. The society joined in the effort that helped to formulate and promote a national water-power law. Delegates were sent to a national conference on a uniform boiler code, and both a national and a Tennessee law were drawn up, the latter failing of passage in the legislature. Investigations of the working of the city charter led to the drawing of amendments designed to make the government more efficient.

In all war activities the association bore its share, especially in promoting enlistment. Thirteen of its members went into service.

Service to the engineering profession was represented by one important item of the association's work, namely, participation in the engineering coöperation conference. This participation continues. In addition the association is represented on the committee of five to devise ways and means for carrying the hoped-for coöperation into effect.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

The American Society's New Constitution

Sir—Having read the letter which appeared in your issue of Feb. 14, over the names of Hunter McDonald and Clemens Herschel, relative to the proposed revision of the constitution of the American Society of Civil Engineers, the circular letter in opposition thereto, and the resolutions adopted at the annual meeting, the writer, as the author and mover of the resolutions, asks the privilege of your columns for the following:

The letter plainly insinuates that the opposition was promoted by the secretary of the society. The resolutions were prepared by the mover after a very careful study of every section of the proposed new constitution, which resulted in the firm conviction that it contained serious defects. The resolutions offered and the outline of the arguments supporting them were shown to and discussed with but one member of the society, and that one member was not the secretary, who subsequently expressed to the writer his lack of sympathy with some of the objections.

It is needless to review the arguments submitted in opposition to the proposed revision, but special emphasis was placed upon the extraordinary provisions which would make it possible for four members of the executive committee to change the by-laws relating to disciplinary measures at any meeting of the committee and deprive any member of the society of rights which should be assured him by the constitution. While it may be inconceivable that such a thing would be done, it would be legally possible were the new constitution to be adopted. Such a defect appears to be fundamental, and that those present at the annual meeting shared this conviction was indicated by the vote in favor of the resolutions, which was almost unanimous, scarcely more than a dozen of the 500 or more present indicating their disapproval.

As to the circular letter in opposition to the proposed constitution, an analysis of which "both as to contents and personnel of signature" is invited by Messrs. McDonald and Herschel, the writer has no apology to offer for the company he was in, these signers including no less than five past presidents of the society. seven former vice presidents and thirty-one former or present directors, one of whom also served as secretary of the society for 13 years. Is it possible that these, as well as the 113 other signers, are simply deliberate or unconscious agents of an individual who is said to have threatened to do all he could to defeat the constitution and "has kept his promise"?

New York City. NELSON P. LEWIS.

Sir—I regret to see in a letter regarding the proposed revision of the constitution of the American Society of Civil Engineers which appeared in your issue of Feb. 14 an insinuation that the secretary of the society inspired the opposition to the adoption of this revision, thereby raising a question as to the good faith of those signing the letter sent to the corporate members of the society. As I took no part in the preparation of this letter, I leave this insinuation to be answered by others, but I deem it only fair to state that in my five years' service on the board of direction of the society—three years as director and two years as vice president—during which period there were many controversies over the constitution and other matters, I have known of no case where the secretary either inspired or took any part in preparing or directing any action intended to influence the members in their votes.

The present constitution has been operative for many years, and with minor amendments from time to time to conform to the growth of the society has served its purpose well. No situation has arisen which it did not adequately meet. The present, while so many of the members are absent on war duty and the minds and hearts of all are occupied with worthier subjects, is not an opportune time to consider such radical changes as are proposed.

One reason alone is sufficient for the decisive rejection of the revised constitution, if no others had been set forth. The membership is again asked to determine the status of the secretary—although only four years ago, by a majority of an extraordinarily large vote, they settled this question—without even the securing, by the revision committee, of the approval of the majority of the entire board of direction.

New York City. J. WALDO SMITH.

Sir—We regret that in the interests of fair play and the welfare of the American Society of Civil Engineers we feel obliged to take part in the public discussion of the questions which have arisen in connection with the proposed revision of the society's constitution. We regret particularly that certain of the members of the society should have, in this connection, made a personal attack upon the secretary.

We will refer briefly to the letter signed by Messrs. McDonald and Herschel in your issue of Feb. 14, and the letter in your issue of Feb. 21, by Messrs. McDonald, Ockerson, Endicott, Davies and Herschel. We suggest that two other letters in your issue of Feb. 21 deserve a careful hearing, namely, the one signed by Charles Warren Hunt and the one by Frederick C. Noble. We find ourselves in agreement with statements made in these two letters.

In the first letter named, exception is taken to the statement in the second paragraph of the resolution adopted at the annual meeting, as follows: "Whereas, it appears that the opinion of the members of the board of direction was greatly divided as to some of the

changes." This statement is correct, and it is true that there were developed in the discussions in the board of direction such differences of opinion.

Referring to the letter by the five members, it is not justifiable to indicate that the members who signed the circular letter of Dec. 31 took an unfair advantage of the membership in sending out their letter, for, as is shown in the letter now under discussion, this circular letter was received a week before the annual meeting, thus giving the members an opportunity to study in advance the involved questions and so be prepared to act affirmatively or negatively.

It is also pertinent to draw attention to the fact that the letter of Past Presidents McDonald and Herschel appeared in your issue of Feb. 14.

Furthermore, this circular letter of Dec. 31 disposes of the statement in the paragraph beginning, "Let no one deceive himself," wherein it is stated that "there was no opposition to or disagreement upon the proposed new constitution" except on the one question of the secretary being a member of the board of direction. This circular letter, to which are attached the names of a number of members of the board of direction, clearly shows that the authors of that letter objected on many other grounds than the one named.

It is stated in the fourth paragraph from the end of the letter now under discussion that the proposed constitution provides for the election of the secretary "at the meeting of the board next preceding the annual meeting." This is an error. The proposed change leaves the time of election unspecified, as is seen by referring to page 14 of the circular issued by order of the board of direction, under date of Dec. 15. This error seems to be an example of marked carelessness in statement in the letter signed by Messrs. McDonald, Ockerson, Endicott, Davies and Herschel, which is evident to anyone who will take the trouble to examine the record.

Furthermore, the undersigned do not agree that the time set for organizing the new board is an inappropriate time for electing the secretary. On the contrary, we believe that that is the best time for electing the secretary, for the meeting is held expressly for the purpose of organizing for the coming year and there is no reason why sufficient time should not be devoted to this important matter.

While we do not question the sincerity of these gentlemen, we feel that one of the five who drafted this letter was led away by his desire to see the proposed constitution adopted and so neglected to consult the records. We believe that if these five gentlemen will study carefully their own letter, and compare its statements with the records, they will be willing to acknowledge that their letter is misleading.

We could furnish other examples of inaccuracy; for instance, the statement "that none of the members in charge of the subject were present at the meeting (annual), and no discussion was had." Presumably, "the members in charge" means the members of the committee including the signers of the joint letter. At least one of the signers of the letter was at the meeting and was free to discuss the proposed revision. The membership had been notified in advance, in accordance with the contsitutional requirements, and so the fact that there was little opposition apparent in the discussion indicated an agreement of the minds of those present in opposition to the revision as proposed.

Again, as another example of inaccuracy, the policy of keeping the secretary a member of the board of direction has not been due to inertia or lack of effort on the part of certain members. A separate and distinct amendent to effect this change, promoted by certain of those now similarly active in promoting this change in combination with other changes, was rejected by the membership by a large and decisive note as recently as 1914.

We do not care to center this discussion on the question of the secretary holding membership in the board of direction, but we would, in the interest of a fuller comprehension of the elements involved, call attention to Article VI, Section 4, of our constitution, which states that "He shall be, under the direction of the president and board of direction, the executive officer of the society." Because our society chooses to call its executive officer by the title of secretary offers no valid reason for excluding him from the board of direction on the ground that secretaries who are not executive officers are not generally admitted to the board of direction. The fact is, the practice of placing the chief executive officer on the board of direction is becoming more and more general.

GEORGE H. PEGRAM.
New York City. ALEX. C. HUMPHREYS.

Thacher Appeal Not Lost, But Dismissed on Motion of Appellee

Sir—In your issue of Jan. 31, 1918, p. 233, there appeared a news item entitled "Thacher's Patent Appeal Lost," in which it was stated that the Court of Appeals had "upheld the lower court decision against the well-known reinforced-concrete bridge patent (No. 617615) rendered by Judge Martin J. Wade on Sept. 12, 1916."

This statement is erroneous. I asked my attorney to secure confirmation of it, and he received the following reply from the clerk of the United States Circuit Court of Appeals of the Eighth Circuit:

"I have received your letter of the 7th instant inclosing copy of a news item relative to the case of Thacher vs. Board Supervisors of Polk County, Iowa, et al., No. 4928, in this court. The news item would indicate that this court upheld the lower court, but that is an error, as the case was dismissed upon motion of appellee without consideration of the merits, so that the decision of this court simply amounts to a dismissal of the appeal. The record was printed in the court below, but copies thereof were not filed within the time required by the rules nor were briefs filed by appellant. I take it that inasmuch as the case was not considered on the merits you do not desire a certified copy of the dismissal of the appeal."

DANIEL B. LUTEN.
Indianapolis.

Regulation of Engineering Practice

Sir—The letter regarding "Intelligent Statutory Regulation of Engineering Practice" published in *Engineering News-Record* of Jan. 10, p. 89, has been read with much interest.

Intelligent regulation is not merely desirable but is decidedly necessary. The legal and medical professions have long seen the need of a certain minimum standard for all practitioners. While the present laws do not eliminate the incompetents they surely do a great deal toward sifting out the unfitted, thereby creating a high standard of service and helping to inspire public confidence.

The engineer, as much if not more than other professional men, needs the confidence of the public. Then, too, the public is justly entitled to some knowledge of the fitness or capability of the engineer it employs.

Proper standard requirements, fixed by law, which must be attained by prospective engineers before they are entitled to practice independently, can in no way produce other than a beneficial effect and a general raising of the engineering standard. Any action tending to stabilize and unify the profession should be welcomed by all engineers.

W. H. BURRAGE,
Assistant Engineer, Valuation Department, New York, Chicago & St. Louis R.R.
Cleveland.

New Staten Island Freight Terminal and Short-Radius Track Layouts

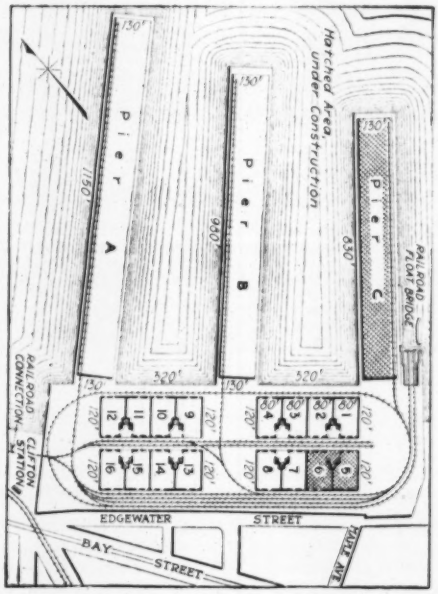
Sir—I have noted with much interest the track plan for the new Pouch terminal now building on Staten Island, as published in *Engineering News-Record* of Jan. 17, p. 120. This plan is of special interest because it appears, in nearly every feature, to be laid out contrary to what is generally accepted as necessary to obtain economical cost of construction and maintenance and ease of operation in a small terminal yard. [For the reader's convenience the plan referred to is here reproduced, but turned 90° to orient it with the modified plan suggested by Mr. Platt.—Editor.]

Eight very serious objections can be made to the plan: (1) Unnecessarily short radii of curves; (2) short-radius reverse curves with a common tangent point; (3) unnecessary number of track crossings; (4) lack of uniformity in size of frogs and switches; (5) use of special frogs and switches; (6) necessity for using standing or loading tracks as operating tracks; (7) absence of flexibility of operation for placing or switching out cars, and (8) impracticability of track connection with float bridge.

The layout at the northwest corner of building 16 demands that three switches be taken off the inside of a curve of not more than 200 ft. radius, and all of this in a distance of not more than 150 ft. along the main track. The curve of the inside switch would be very sharp, and the whole would be something in the nature of a four-way switch. At the point of the switches is another turnout in the reverse direction, leading to pier A, and all of this aggregation is at the common tangent point of two sharp reverse curves and in a piece of track which would be run over more than any other. Possibly the four-way switch could be built, but no guard rails could be laid through the switches.

On a curve of any radius less than about 104 ft. the corners of box cars will often jam when pushed around the curve, and stiff steel cars 40 ft. long will seldom take such a curve. I once laid out, to reach an otherwise inaccessible point, two reverse curves of respectively 120 and 125 ft. radius, with connecting tangent only 15 ft. long. I stayed several years in charge of that yard and spent considerable of that time trying by banking, gage widening and guard railing to keep cars on that piece of track—and dodging the wrath of the yardmaster.

Seven track crossings are shown on the plan. These are expensive things to build, install and maintain, and



PUBLISHED PLAN, WHICH THIS LETTER CRITICISES

apparently two of them might have been omitted; in fact, all but one at the north property line could have been left out had the approach to the piers been made from a second or running track along the bulkhead.

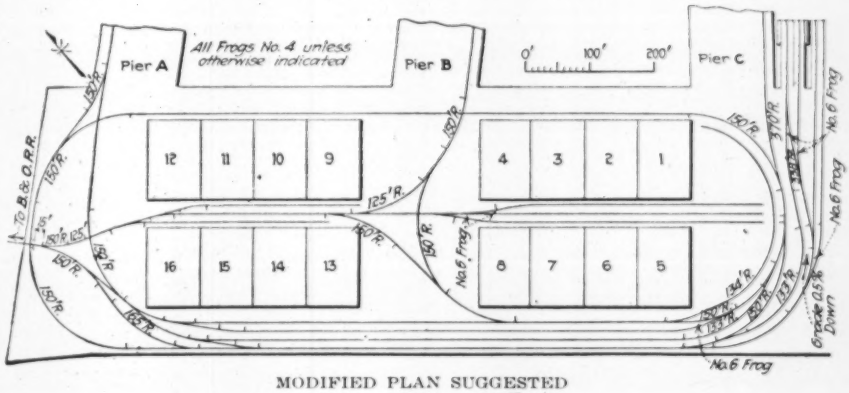
The use of odd-size frogs involves considerable extra first cost, and the use of different sizes necessitates, of course, carrying many in stock

In the operation of this yard there would be an immense amount of running around. The movement to the float bridge and pier C is opposite to that to piers A and B. This means slow, difficult work and the possibility that one extra track must be left open for this purpose. Here again the additional track along the bulkhead would be useful in permitting cars to run on piers A and B in the same direction as to the float bridge.

Of course all loading tracks should, so far as possible, be kept clear of movements for all other tracks. On the published plan, all cars to and from the tracks between buildings 1-4 and 5-8 would have to move over the loading tracks between buildings 9-12 and 13-16, and cars placed along the west side of buildings 5-8 would have to be pulled to clear a track for movement to or from pier B.

The operation of the yard involves the switching of cars in and out for the Baltimore & Ohio R.R., for floats for pier tracks, tracks alongside warehouses and possibly for team tracks—evidently, with the reverse movements required and the lack of room, involving very difficult operation.

The plan of tracks to the float bridge is altogether impracticable. On the north track to the bridge the distance between the inshore end of the bridge and the first switch, which switch must be at dock level, is not more than 160 ft. Taking the elevation of the deck of the level bridge as 7.5 (New York Dock Department datum) and the yard level at 9.5, this makes the tracks from the bridge ascend on a 1.25% grade. Add to this the grade of the bridge itself, which is 2% at mean low water and often more than 3% at very low water, and also the resistance of the curve equal to about 0.9% grade, and the whole makes a very formidable grade to operate on with a locomotive which is necessarily light because of the sharp curves it must run over. Bridges are operated over tracks as steep as these, but the grades should be reduced if possible. Another serious objection to steep grades to the bridge is that, at high tide, the tops of box cars will often jam where they meet at the intersection of the down grade to the bridge and the up grade on the bridge.



MODIFIED PLAN SUGGESTED

On the published plan the nearest crossing between the two tracks to the bridge is 1400 ft. back from the bridge. In pulling a two-track float, heavily loaded, when all the cars cannot be removed from one side at once, the locomotive must make the crossing twice. In this case to pull a 12-car float the engine would have to travel, starting from the offshore end of the bridge, at least 7900 ft. to put the float load of cars on one of the long tracks in the yard. For 2700 ft. of this distance the locomotive would travel light. If a crossover were provided near the end of bridge, these cars could be placed in the yard with a locomotive travel of not more than 3700 ft., only 500 ft. of which would be light.

For the relief of the rest of the yard and quick release of the float, tracks should be provided near the bridge to hold at least one float load, either for a full load coming in or for assembling a load to go out, and a run-around near the end of the bridge would add materially to the flexibility of such a yard, requiring reverse movements as it does.

To illustrate the points I have made, I submit the accompanying plan, utilizing as far as possible the general layout published. In this plan there is no curve of less than 125 ft. radius, which is that of the shortened lead of a No. 4 switch using 7½-ft. straight switch points and a straight-rail frog. All frogs are either No. 4 or No. 6.

There are five crossings on this plan instead of seven. The movement of all cars is in the direction of the float-bridge movement except in the case of pier A. The tracks for warehouse loading are independent of movement over all other tracks. There is a tangent of at least 30 ft. between all reverse curves.

A wye is provided, more by accident than design, which may prove very convenient for turning a box car with a broken drawbar or knuckle, a door that will not open or a load that has shifted and tilted the car so it will not clear some point; or for turning a locomotive when its flanges have worn more on one side than the other, as often happens when the locomotive has run some time over sharp curves most of which are in one direction.

FRANK E. PRATT,
Consulting Engineer.

New York City.

[The article which gave rise to this letter said little or nothing about the track plan, being confined chiefly to the one pier and two warehouse units now under construction. It is likely that the track layout for the whole terminal is more or less tentative, and it is the function of neither this journal nor Mr. Pratt to tell the terminal company at long range how to build its plant. At the same time the criticisms seem to be pertinent, and they are a reminder of a rather common tendency of terminal and industrial-plant designers to fix the locations of their buildings and perhaps erect a few, and then call upon the track expert to fit in a workable track scheme. And the results are frequently unsatisfactory. The importance of the track plan should not be underrated, and the best operating results can be obtained only when this plan is worked out as a vital part of the whole scheme.—Editor.]

Board of Consulting Engineers Recommended

In his annual report for the calendar year 1917, submitted to the Columbia, S. C., city council on Jan. 8, T. Keith Legaré suggests that the council "appoint a board of consulting engineers to give expert advice and information to the council on any matters referred to" the proposed board. He suggests that the board be empowered "to make recommendations on any subject connected with the administrative work of the city government." He adds: "Atlanta, Ga., has such a board and the mayor of that city reports that it has been of great assistance." The Atlanta board is composed of local engineers.

Can Issue More Water Bonds

Hereafter outlays for water-works construction will be excluded from bonded debt limit calculations affecting New York City, Buffalo and Rochester as a result of a constitutional amendment adopted on Nov. 6. The vote, which was officially announced on Dec. 31, 1917, stood 591,728 to 420,303, or a majority of 171,425 in a total of 1,012,031. The highest number of ballots cast at the election was 1,443,734, for attorney general.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Short Base Cast in Advance Makes Setting of Column Forms Easy

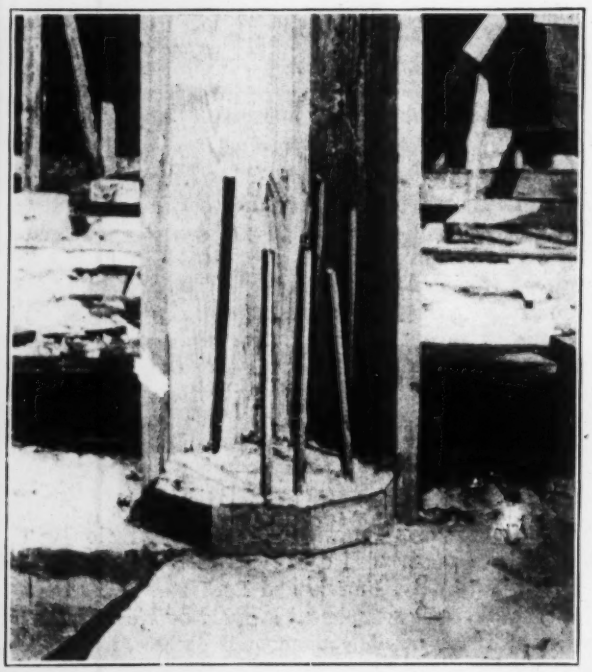
By Howard L. Richardson

Resident Engineer, the Lorain County Electric Co., Lorain, Ohio.

IN BUILDING concrete columns at the Edgewater power plant of the Lorain County Electric Co., at Lorain, Ohio, time was saved in centering and adjusting column forms by building 4-in. bases in advance of this work. As soon as the column centers were established on a finished floor, forms for the middle row, built of 2 x 4's 4-in. deep, were placed and this small base poured for each column. The full length column form was then centered on this concrete templet. Outside wall forms and the adjacent column forms were braced against these middle column bases so that all could be held in exact position. In the case of columns having flaring tops, when the column form was found to be a trifle low it was easy to wedge it up the desired amount from the floor, the 4-in. base supporting a casing steel at the bottom. The same mixture is used for the 4-in. base as for the rest of the column, so that no discoloration or seam appears.

Some of the column bases were cast in zero weather by using a hand torch to melt all ice and snow on the floor inside the forms, and by using hot water to mix the concrete. As soon as poured the bases were covered with snow. In two days this was removed and the concrete found in excellent condition.

The photograph shows how reinforcing rods were allowed to stick up through the floor in the column base, giving a lap of about 2½ ft. in the upper part of the column.



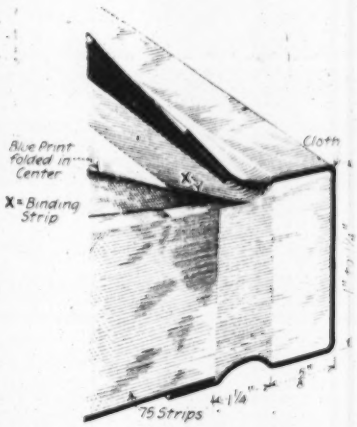
PRECAST BASE CENTERS AND SEALS FORM

The plant is being constructed by the Utilities Construction Co., Lorain, Ohio, for which W. J. Donnelley is superintendent.

Blueprints Bound in Center, Each on Separate Gummed Strip

STIFF paper covers with cloth backs used by the Dravo Contracting Co. of Pittsburgh, Penn., are made to hold blueprints folded once, so that each print may be opened flat, with no part of the drawing or margins inaccessible.

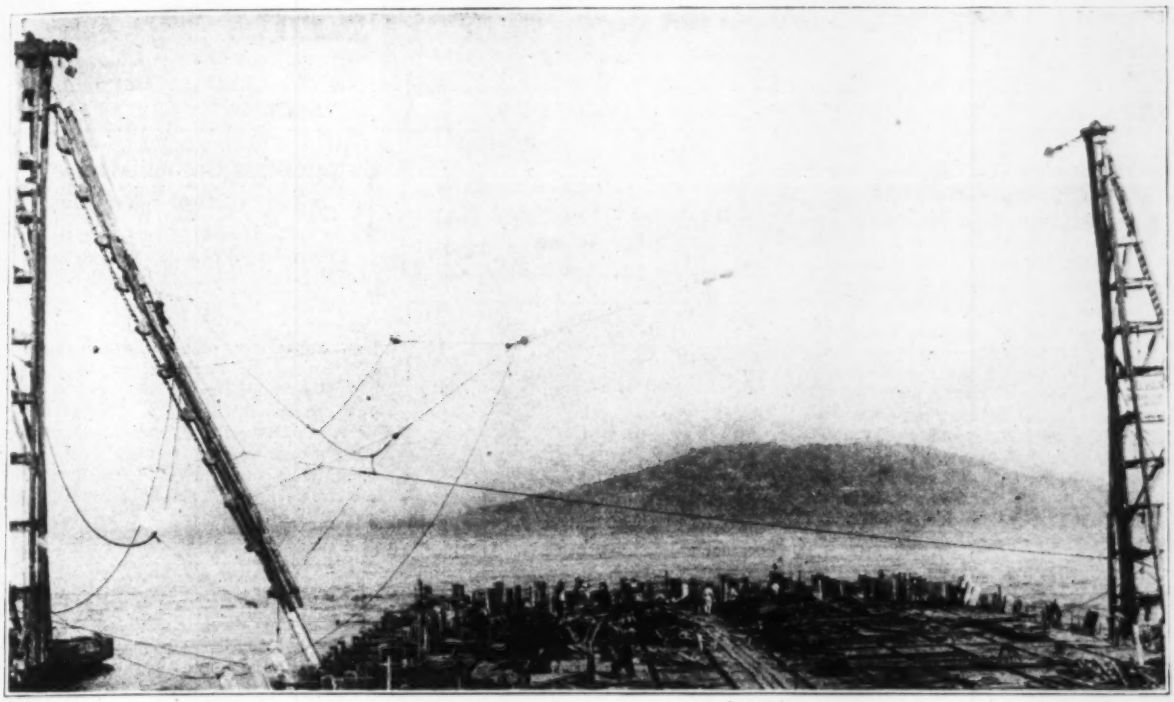
To the cloth back, which may be 1½ in. or 2 in. wide, are pasted and fastened together by means of wire staples a number of gummed strips. These gummed strips have a loose or projecting edge about 1¼ in. wide to which the blueprints are pasted. The 24 x 36-in. prints are folded once, making a size 24 x 18 in. The back of each print on one side of the fold is pasted to the outstanding edge of the gummed strip. This holds the print on only one side of the fold, making it easy to flatten out and read. The stiff paper or fiber side of the binder is 19 x 25 in., making the books easier to file than binders bound flat by one edge. The full size prints (24 x 36 in.) bound in this way take up little more room than photostat reductions, which are not always legible.



Use Second Piledriver to Hold Out Hinged Leads

THE chief problem involved in satisfactorily handling 105-ft. reinforced-concrete batter piles on this concrete ferry slip job in San Francisco was that of holding the pile at the desired angle of 30° for driving. This was done as shown in the accompanying illustration, by using as a supporting tower a second piledriver. Cables were run to pull the pile from the top of this second driver into the desired position.

The piles were brought to the work on scows and were picked up in the usual manner and placed in a pair of swinging leads suspended by tackle from the top of the driver frame. Although the piles were much longer



LEADS READILY PULLED TO THIRTY-DEGREE ANGLE

than these leads and projected above the top when first slung into position, they sank in the mud far enough so that the steam hammer working in the leads could work on the pile head.

While the swinging leads were hung in a vertical position, tackle from the driver across the pier was attached to the swinging leads at four points and this tackle was tightened by lines running to the two drums on the second piledriver. Both piledrivers, of course, were held in position by suitable lines to the pier itself or across the slips in which they were working. Fifty piles were driven in this manner. A maximum penetration of 75 ft. was obtained in the soft mud bottom.

A No. 0 Vulcan steam hammer which has a 7500-lb. ram operating on a 4-ft. stroke was used.

The work was done under the direction of Frank G. White, chief engineer, California State Board of Harbor Commissioners.

Repairing a Dragline Excavator Drum in the Field Shop

By J. W. Owens
434 W. 11th St., Erie, Penn.

HERE are two field repairs that we made to keep a dragline excavator in operation that may prove useful to other construction superintendents or contractors. A deep rut was worn on the surface of the drum. This caused a great deal of trouble in reeling up the line. So I fastened a heavy timber across the bed of the frame and bolted a universal tool post and slide on this timber. Then I had the operator rotate the drum slowly while we turned it down just as though we had the drum on a big lathe. The job took six hours and the drum was a perfect cylinder when finished.

Then the drag drum got worn through in spots at the end where the brake belt works on the drum band. I had this drum taken out and brought to our machine shop, where we had a lathe big enough to accommodate it. We turned the band completely off the drum. Then we had patterns made for a new band in four segments. Steel castings were made, bolted to the drum and turned up true. This made a first-class job and gave us practically a new drum at one-quarter of the cost. When any segment becomes worn now we can bolt on a new one and turn it down to size in place.

Toothless Metal Saws in Germany

Quickly-revolving smooth steel disks are now being used in Germany for cutting metals, with results said to be better than those obtained with toothed saws. The actual cutting is not effected, as was formerly understood, by removing the metal, reports the *Scientific American*, but by the heat generated by the friction between the rapidly revolving disk and the metal. That heat is so great that the metal is melted at the point of contact. The disk has consequently only to discard the molten metal, and so clear the dividing groove. Naturally the steel disk also becomes heated in the operation, but as the greater part of its circumference is always out of contact, and continuously being cooled by air, its own heat remains always below the melting point. When that fact was realized, toothless saws were soon constructed which were able to cut through all metals in a minimum of time. The advantage over the toothed metal saws is that the disks do not wear out so quickly.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Minnesota Society Meeting Lays Stress on Human Elements

The annual meeting of the Minnesota Surveyors' and Engineers' Society, held at Duluth, Feb. 21-23, differed in many respects from those which have gone before, not only because fewer technical papers were presented and there was more opportunity to discuss them, but also because it gave evidence of widespread interest in the more human elements of such a meeting—sociability, society activities and professional unity.

The presidential address by John Wilson dealt with the lives of engineers from 1724 to 1848, and the beginning of engineering as a profession. It was a profitable review of the history of engineering by means of which those present gained a wider horizon and a better conception of their relation to the world at large.

However, technical matters were not neglected. Papers on tar treatment of roads, the nonpressure treatment of bridge timber with creosote oil, and on the work of the State Highway Department brought forth the most constructive discussion in years on methods and results along these lines. Papers were read also on garbage and refuse disposal and the Camp Dodge cantonment.

A paper by W. A. Clark, chief engineer of the Duluth & Iron Range Ry., on government ownership of railways, was discussed by F. E. House, president of the same road, and by others. It dealt with the largest and most serious problem of the day aside from winning the war.

The report of the railway committee of the society, made by J. L. Pickles, chief engineer of the Canadian Northern, stated that the auto truck has now entered into sharp competition with the railways and is operating upon publicly maintained thoroughfares. It was pointed out that the auto truck and the railways should really be compotent parts of the same general scheme of transportation, which, linked with adequate water shipping facilities, would make an ideal transportation system.

The principal speaker at the banquet was C. E. Drayer, secretary of the Cleveland Engineering Society. His talk on "Engineering Unity" met with a hearty response. The engineers of Minnesota have also been working for engineering coöperation and as a result have formed the Minnesota Joint Engineering Board. Other speakers at the banquet were W. L. Darling, who gave his experiences as railway representative to Russia on the Stevens Commission, and Dean John R. Allen, University of Minnesota, who talked on his engineering experiences in Turkey.

Entertainment features were furnished in the evening by the Oliver Iron Mining Co., which presented five reels of moving pictures illustrating mining operations in Minnesota. Those astronomically inclined visited the private observatory of J. H. Darling, a retired engineer who refuses to retire mentally, and who at an expense of $22,000 has equipped this observatory for the benefit of the citizens of Duluth. A visit to the plant of the Universal Portland Cement Co. near Morgan Park, the famous steel city, was made.

The society elected C. H. West, St. Cloud, president, and C. H. Stewart, St. Paul, secretary, for 1918.

Engineer Officer Who Lost Life When "Tuscania" Was Torpedoed

CAPT. PHILIP V. SHERMAN

[Notice of Captain Sherman's death was published in last week's Engineering News-Record.]

Texas Has $500,000 for Through Route Construction

Money for the construction of the Meridian road, one of the main north and south trunk lines in Texas, is available from Federal, state and county aid to the extent of nearly $500,000. Thirteen counties have already met the appropriation made by Federal and state aid. The Meridian road branches at Waco, one section leading through San Antonio to Laredo and the other running southeast to Corpus Christi.

Engineering Council Holds Its First Annual Meeting

Elects Officers and Adopts Definition of Principles—Promotes United Action of Founder Societies

The first annual meeting of the Engineering Council was held Feb. 21. The following officers were elected: Chairman, J. Parke Channing; first vice chairman, Harold W. Buck; second vice chairman, George F. Swain; secretary, Alfred D. Flinn. Committees were appointed as follows: Executive committee, the chairman, the two vice chairmen and David S. Jacobus, Calvert Townley, George J. Foran; finance committee, E. Wilbur Rice, Jr., chairman; Charles F. Loweth, Sidney J. Jennings, David S. Jacobus; rules committee, J. Parke Channing, chairman; Clemens Herschel, Nathaniel A. Carle, Irving E. Moultrop; public affairs committee, Charles Whiting Baker, chairman; George F. Swain, Benjamin B. Thayer, E. W. Rice, Jr., Charles E. Skinner. American engineering service, George J. Foran, chairman; George C. Stone, Alfred D. Flinn, Dr. Addams S. McAllister, Edward B. Sturgis, secretary; war committee of technical societies, D. W. Brunton, chairman; Arthur H. Storrs, secretary; James M. Boyle, Nelson P. Lewis (American Society of Civil Engineers), Edmund B. Kirby (American Institute of Mining Engineers, A. A. Greene, Jr., R. N. Inglis (American Society of Mechanical Engineers), Harold W. Buck, Dr. Addams S. McAllister (American Institute of Electrical Engineers), Dana D. Barnum, E. C. Uhlig (American Gas Institute), Joseph Bijur, Dr. Charles A. Doremus (American Electrochemical Society), Louis B. Marks, Preston S. Milar (Illuminating Engineering Society), Christopher R. Corning, George C. Stone (Mining and Metallurgical Society of America), Henry Torrance, F. E. Matthews (American Society of Refrigerating Engineers); fuel conservation committee: L. P. Breckenridge, chairman; Ozni P. Hood, secretary; Robert H. Fernald, Charles R. Richards, Charles L. Edgar, Carl Scholz, David Moffat Myers, Edwin Ludlow, Harold W. Buck.

The definition of the Engineering Council that was adopted declared that "the Engineering Council is an organization of national technical societies of America created to provide for consideration of matters of common concern to engineers, as well as those of public welfare in which the profession is interested, in order that united action may be made possible. The Engineering Council is now composed of the American Society of Civil Engineers,

the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, having a membership of 33,000 and known as the 'Founder Societies.'"

Capital Issues Committee Lowers Municipal Limit

Will Advise Whether Bonds Amounting to $100,000 or More Are Compatible with Public Interest

The capital issues committee of the Federal Reserve Board, recently appointed to control the issuing of new securities during the war, announced that, upon the recommendation of its advisory committee, in view of the large aggregate of municipal issues offered in relatively small amounts, it had decided to reduce from $250,000 to $100,000 the minimum limit on municipal issues upon which it would give advice with respect to the question of whether such issues at this time were compatible with the public interest.

In a great many districts the majority of the municipal issues (and particularly those that might well be postponed at this time) are of amounts smaller than $250,000, and it was for this reason felt desirable to make this change.

The advisory committee has been in close touch with all local committees established by the twelve Federal Reserve Banks, and all personal presentations of applications are being made to them.

A conference has been arranged between the capital issues committee and its advisory committee and representatives of the Public Service Commissions of the United States for Thursday, Feb. 28.

The support which the committee had received from all parts of the country was most encouraging, said its chairman.

Urges Higher Compensation for Engineers

At the conference in Washington Feb. 26, between representatives of capital and labor, held to forward the adoption of a national labor policy, a representative of the Engineering Council urged the necessity of higher compensation for engineers, to enable them to take their proper part in the nation's activities in war and peace.

Wisconsin Course In Wood Inspection

A special course in wood inspection will be given by the Forest Products laboratory at the University of Wisconsin, Madison, during the second semester of the present term, especially for engineers interested in the characteristics and the properties of wood as applied in airplane construction. It will be similar to that now given at the laboratory to airplane inspectors.

Contractors Who Are Now Engaged on Construction Work Under the Cantonment Division, Q. M. G. O.

(Reprinted from Engineering News-Record, Jan. 31)

Fort Leavenworth U. S. Disciplinary Barracks	E. B. Yoakum, Fort Leavenworth, Kan.
Fort Newark Terminal	McArthur Brothers, Newark, N. J.
Animal Quarantine Depot, Baltimore, Md.	J. E. Watson Co., Baltimore, Md.
Extension of General Hospital No. 1, New York City	William Crawford, Williamsbridge, New York City.
Curtis Bay Ordnance Depot	Smith, Hauser & MacIsaac, So. Baltimore, Md.
Raritan River Ordnance Depot	Snare & Triest, Metuchen, N. J.
Pig Point Ordnance Depot, Pig Point, Va.	James Stewart & Co., Norfolk, Va.
Baltimore Depot Warehouses, Baltimore, Md.	Sanford & Brooks Co., 9th to 11th Sts., Baltimore, Md.
Addition to Animal Embarkation Depot, Newport News, Va.	Westinghouse Church Kerr Co., Newport Va.
Fort McHenry Hospital, Fort McHenry, Md.	J. Henry Miller, Inc., Fort McHenry Hospital, Baltimore, Md.
Fort Worth Experimental Station, Fort Worth, Texas	Bryce Building Co., Experimental Signal Station, Fort Worth, Texas.
Fort Des Moines Hospital, Iowa	Charles Weitz Sons, Fort Des Moines, Iowa.
Philadelphia Q.M. Expeditionary Storage Depot	William Steele & Sons Co., 4th and Walnut Sts., Philadelphia, Penn.
Chicago Q.M. Interior Storage Depot	Central Mfg. District, Chicago, Ill., 39th St. and Ashland Ave., Chicago, Ill.
St. Louis Q.M. Interior Storage Depot	Westlake Construction Co., 2nd and Arsenal Sts., St. Louis, Mo.
Pittsburgh Q.M. Interior Storage Depot	The Austin Company, 8th and Butler Sts., Pittsburgh, Penn.
Addition to Coast Artillery Post, Pensacola, Fla.	Hugger Bros., Montgomery, Ala.
Addition to Coast Artillery Post, Galveston, Texas	Horton & Horton, Houston, Tex.
Addition to Coast Artillery Post, Boston, Mass.	I. F. Woodbury Sons Co., Boston, Mass.
Addition to Coast Artillery Post, Mobile, Ala.	Jetts-Muths Construction Co., Inc., Mobile, Ala.
Addition to Coast Artillery Post, New Bradford, Mass.	McNally Construction Co., Fall River, Mass.
Addition to Coast Artillery Post, Portland, Me.	F. W. Cunningham & Sons, Portland, Me.
Addition to Coast Artillery Post, Charleston, S. C.	Gallivan Building Co., Greenville, S. C.
Cantonment for Engineer Troops, Belvoir, Va.	P. F. Gormley Co., Washington, D. C.
Philadelphia, Penn., General Depot	William Steele & Sons Co., Philadelphia, Penn.
Washington, D. C., Telephone Building	Frank L. Wagner, Washington, D. C.
Cantonment Buildings, Leon Springs Training Camp	Weston & Kroeger, San Antonio, Tex.
Cantonment, San Juan, Porto Rico	Purdy & Henderson Company, New York & Havana
Tuberculosis Sanitarium, Otisville, N. Y.	R. H. Howes Construction Co., New York City.

New Contracts

North Island, Calif., Signal Corps	William E. Hampton Company, Los Angeles, Calif.
Storage and Terminal Facilities, Norfolk, Va.	Porter Brothers, Detroit, Mich.
Ordnance Storehouse & Barrack Buildings, Augusta, Ga.	McKenzie Bldg. Co., Augusta, Ga.
Mechanical Repair Shop, Atlanta Ga.	Mackie Construction Co., Atlanta, Ga.
Colonial Hospital, Iselin, N. J.	Cauldwell-Wingate Co., New York, N. Y.
Mechanical Repair Shop	Edward L. Scheidenheim Company, Chicago, Ill., Baltimore Md.
Temporary Buildings, Saybrook, Conn.	Sperry Engineering Company, New Haven, Conn.
Gas Development Plant, Otto, Kansas	Dictor & Wensel Construction Co., Wichita, Kansas.
Hospital Building, Fox Hills, Staten Island.	The Thompson-Starrett Company, New York.
Aviation Training Camp, West Point, Miss.	George J. Glover, New Orleans, La.
Signal Corps, Storehouse, Ft. Sam Houston, Texas	Thos. Herman Co.
Aviation Field, Americus, Ga.	Hardaway Constr. Co.
Aviation Field, Riverside, Calif.	Twohey Bros. Co., San Francisco.
Aviation Field, San Diego, Calif.	Wm. E. Hampton Co., San Francisco.
Hoboken Expeditionary Depot, Hoboken, N. J.	Barney-Ahler Constr. Co.
New Britain Machine Shop, New Britain, Conn.	Aberthaw Constr. Co., Boston.

Wisconsin Engineers Discuss War and City Contracts

Municipal contracting systems and the relations between engineers and contractors on public works were subjects of an animated discussion that occupied nearly an entire session of the annual meeting of the Engineering Society of Wisconsin, held at Madison, Wis., Feb. 22-23.

This discussion was started by a committee report on "Standardization of Plans for Street Improvements," in which certain unreasonable clauses and requirements of specifications and contracts were presented. Bonding companies, contractors' bonds, inspection and the "cost-plus" as compared with the competitive bidding method of placing contracts all came in for discussion. One point made was that if a contract is required to be let to "the lowest responsible bidder" the engineer or other authority should make sure that the contractor himself is really responsible, and should not be satisfied because he has the backing of a responsible bond-

ing company. Getting work done by such a company after a contractor has failed to do it is rarely a satisfactory proceeding.

The engineers' work in support of our military activities in the present war was emphasized in a series of papers. Dean F. E. Turneaure, University of Wisconsin, spoke on "The University in War Service," outlining the various kinds of experimental and technical assistance rendered by the several departments. Maj. W. F. Reichardt described the sanitary engineering work of all of the Southern cantonments. The housing of labor as an important factor in promoting the rapid production of ships, munitions and supplies was the subject of a talk by Prof. L. S. Smith, who showed a number of views of good and bad housing conditions and workmens' dwellings.

Housing Facilities Urgently Needed

Housing facilities good in quality as well as ample in quantity are needed urgently, since men and women who live in dirty, crowded, unsanitary and uncomfortable quarters cannot do as much or as good work as would be possible in better conditions of housing and living. In regard to the establishment of new residential accommodations for labor in the vicinity of large manufacturing centers Professor Smith favored permanent construction, for when the war is over workmen will not be willing to return to the old conditions of living.

Roller and belt finish for concrete roads, and the methods of handling materials and charging concrete mixers, were two construction subjects presented.

Danger to Road System

Road construction and maintenance according to a broad and systematic program was urged strongly by A. R. Hirst, state highway engineer. He referred to the harm done by well-meant attempts at economy by shutting off work arbitrarily. Even if road development should stop for a period of a few years the development of motor vehicles would not stop and at the end of that time it would be found that the road system was practically destroyed. On the other hand, the great increase in prices of material makes it necessary to use judgment so as to spend money only on the roads which warrant the expenditure. Thus a well thought out program of road work is necessary for proper economy as well as for transportation conditions.

Highway Departments Conference Elects Officers

The Mississippi Valley State Highway Departments at their tenth annual conference in Chicago, Feb. 11 and 12, elected John H. Mullen president and Clifford Older, chief engineer Illinois State Highway Department, secretary.

Unfiltered Water Ordered Shut Off at Montclair, N. J.

Intestinal Troubles Followed Partial Supply of Water Which Had Been Chlorinated Only

At the request of the town officials of Montclair, N. J., backed by a delegation of citizens, the New Jersey State Department of Health, on Feb. 19, suspended its permit, granted a short time previously, under which the various water companies owning the water filtration plant at Little Falls, N. J., had been authorized to supplement their filtered and chlorinated supply with some 10% of water which had been chlorinated only. The Montclair authorities asserted that the supplementary or diluting water was a menace to health. This had been proved, in their opinion, by an extensive outbreak of intestinal disturbances in Montclair and some of the other communities receiving this water supply in January, following an earlier use of unfiltered water from this source.

The Little Falls water-filtration plant was a pioneer in modern mechanical water-filtration systems and has been generally considered a model. Water from this plant is supplied to Paterson, Passaic, Montclair, and a number of other communities by various companies associated with the East Jersey Water Company.

Source of the Supply

The supply is drawn by gravity from the Passaic River at Little Falls, some five miles above Paterson, then filtered and pumped. One force main goes directly to Paterson and Passaic. Another goes to and through the easterly part of Montclair and on to Bayonne. The first branch from this trunk line feeds Montclair and West Orange, the West Orange supply being taken from the extremities of some of the mains in the Montclair distribution system. Other branches feed Bloomfield and Glen Ridge, and there is a return loop to Passaic. Storage for the 51-in. trunk main through Montclair is afforded at the Great Notch reservoir, just north of the Montclair line.

Prior to the beginning of the severely cold weather of the present winter, one of the pumps at Little Falls broke down. As a result of the diminished supply, the Cedar Grove storage reservoir was heavily drawn upon. A combination of the pump breakdown and the excessive draft through cold-weather water waste (none of this waste occurring in Montclair, as explained later) resulted in the depletion of the supply in the storage reservoir.

Just at this time similar excess consumption and waste of water in Jersey City so badly overtaxed its supply (which is from an entirely different source) that the Jersey City waterworks was unable to supply railway lines entering Jersey City, including the Hudson and Manhattan tubes beneath the Hudson to New York. The East Jersey Water Co. was called upon to supplement the Jersey City supply and relieve the railway situation by drawing water from the large main already mentioned as passing through Montclair to Bayonne. There appears to be a conflict of statements as to whether this supplementary supply was or was not given at the order of Secretary McAdoo who, it is interesting to note, in his capacity of Secretary of the Treasury is head of the United States Public Health Service, while since Jan. 1 he has been Director General of the railways of the United States, including the Hudson and Manhattan tubes.

State Board Not Consulted

When the East Jersey and associated companies helped out Jersey City, their filtration plant was already working to the limit. The only way it could supply more water was to furnish water that had not been filtered. Under a New Jersey law neither this nor any other company or municipality may change its source of water-supply without notifying the State Board of Health. Notwithstanding this statutory provision, the company pumped unfiltered water into the trunk mains without first notifying the state authorities, and also without previous notification to consumers or the various municipalities concerned.

Within a few days after the delivery of unfiltered but chlorinated water, this water being mixed with that which had been both filtered and chlorinated, an extensive outbreak of intestinal disturbances occurred in Montclair and in the adjoining borough of Glen Ridge. There was also a considerable number of cases reported in Bloomfield, but relatively few in West Orange. The other communities supplied with water from Little Falls seem to have escaped the outbreak of intestinal disturbances, except perhaps Bayonne. The number of cases in Montclair seems to have been upward of 1500 in a population of some 26,000. The trouble appears to have ranged from very minor discomfort of the stomach to troublesome diarrhœa, but with a general if not practically complete absence of temperature. There seems to have been no authenticated deaths in any of the communities affected. Moreover, so far as Montclair is concerned, there has been no typhoid since September, 1917. Analyses of the water supplied to Montclair were made every three days up to about the middle of January and have been made every day since then. These showed nothing unusual, which in the case of the Montclair supply means water of very high grade so far as disclosed by analysis.

When the Montclair authorities learned that the town was receiving water a portion of which had been chlorinated only, instructions were at once given to the citizens to boil the water. These instructions have been continued and the practice seems to

have been kept up quite generally ever since. The disturbances soon died out.

The portion of the supply which was chlorinated only was not continued very long, the Montclair authorities having appealed to the State Department of Health, and the latter having ordered a discontinuance of the supply which was being delivered without filtration. This discontinuance in turn did not last, because of an appeal to the State Department of Health made by the authorities of Paterson, who asserted that there would be dangerous water shortage in their community if no more waetr was supplied than could be furnished by the filters. It appears that the Montclair authorities were not represented at the hearing, which resulted in restoring the portion of the supply which is chlorinated only. Since then it is reported that a second Federal order to supply Jersey City has been issued to the water companies. At present there is little if any need for this supplementary supply.

At the hearing on Feb. 19, granted to the Montclair authorities, the latter represented that Montclair was being not only subjected to further danger from an unfiltered supply, but that it was being unfairly treated to make good faults prevailing in other municipalities. Montclair, which is 100% metered, showed a decline rather than an increase in water consumption during the extreme cold weather. Paterson, which is only partly metered, showed an enormous increase in water consumption and waste. Why, the Montclair authorities asked, should they be supplied with unfiltered water when Paterson did not curtail waste?

It was also urged at the hearing given to Montclair that its people were getting more than their due proportion of the unfiltered water owing to the pumping and piping connections. This the representatives of the company did not admit.

Montclair Charges Discrimination

It was also suggested that the outbreak of illness in Montclair, Glen Ridge and Bloomfield might have been due to the stirring up of sedimentary deposits in the 51-in. trunk main passing through Montclair. This main was put in operation before filtered water was supplied, but that was some years ago. The extra pumpage to supply Jersey City passed through the 51-in. trunk main. The first branch from this main, and therefore the one that would get the larger proportion of any sedimentary deposits stirred up, leads to Montclair. The volume of water and therefore the velocity through the pipes during the first of the two periods when Jersey City was supplied appears to have been considerably higher than ever before.

Those who assume that the outbreak of intestinal troubles in Montclair and other communities was due to stirring up of sedimentary deposits think this might have carried living or dead organic matter, or decomposition products of organic matter, or possible some mineral substance, rather than pathogenic organisms.

Still another theory which has been advanced by those who have been giving attention to the outbreak is that it was a straight case of polluted water. They argue that in the first place the small sewage treatment plants in the Passaic drainage area above Little Falls were doing very little effective work on account of the extreme cold weather; that the river flow was very low at this time owing to extreme cold, and therefore the diluting volume of water small; and that the efficiency of chlorination was materially lessened by the extreme cold. This theory, it has been urged in rejoinder, does not explain why a few communities, and a relatively small percentage of the total population supplied, should have suffered from the intestinal disturbances and all the others should have escaped.

Measures for Protection

The Montclair authorities have spared no pains to protect their citizens since the possible danger from this water-supply became apparent. In addition to the analyses made regularly once in three days by the local health department, Hill & Ferguson, New York City, were engaged to look after the interests of the town. A night man and a day man have been continually maintained at the Little Falls filtration plant on behalf of Montclair to collect hourly samples for analysis at the Hill & Ferguson laboratory. The extra expense incurred by Montclair to supervise the character of its water-supply has amounted to more than $25 a day.

Milwaukee Increases Its Budget; Will Study Water-Supply

Money, to the extent of $30,000, for the investigation of all methods of water purification, has been included in the 1918 budget for departments in the city of Milwaukee not operating on a cash basis.

The total budget is $7,624,785, an increase of $1,611,480 over that of 1917, and includes an increase in virtually every department and bureau under the head of public works. The water department gets $1,250,000, twice the 1917 allowance; and the bureau of street sanitation gets $1,050,000, an increase of $210,000.

Bond issues voted on favorably Dec. 28 by the city council were as follows: Planning and construction of sewerage system, $1,460,000; sewer construction, $360,000; permanent harbor improvements, $350,000; school buildings and sites, $500,000; bridge at Cedar and Biddle Sts., $250,000; at North Ave., $200,000; at State and Martin Sts., $150,000; rebuilding Sixteenth St. viaduct, $200,000; electric-lighting system, $500,000; grade crossing abolition, $950,000; Lakeshore Drive, $300,000; purchase and improvements of park land, $150,000; public bath house, $70,000; hospitals, $50,000; new central police station, $250,000.

Iowa Society, Sectionalized, Takes in Drainage Engineers

By dividing itself into three sections, municipal, drainage and highway, the Iowa Engineering Society has made possible a material broadening of its scope and influence, because these groups embrace most of the civil engineers in the state. The 99 county engineers compose a comparatively new group interested mainly in highways. The drainage engineers have not much in common with the municipal group. Concomitant with the formation of the drainage section was the extension of membership to the members of the Iowa State Drainage Assn. without payment of initiation fee or other recommendation than membership in the association. While the membership of the latter organization has been drawn from farmers, drainage commissioners, attorneys, contractors and engineers, practically all have dropped out except a few contractors and the engineers. This action on the part of the engineering society will probably result in the disbanding of the drainage association, which has accomplished its early legislative and educational aims. The society is ambitious and foresees the possibility of electrical and mechanical sections, all of which can then function as units. It is groping too for some engineering organizations in the adjoining state. Keyes C. Gaynor, in his presidential address, suggested closer relation with these societies with a view toward coöperation on such questions as exchange of membership, legislation, employment, ethics, standard contracts for engineering service, fees and publicity. A committee headed by Mr. Gaynor has the matter in charge and sent word to the Wisconsin Engineering Society, which met later the same week, of its willingness to open preliminaries.

Much work was done by the committee on standard fees. A few revisions of those adopted last year were recommended, but they were not acted upon. The committee is working toward a standard contract segregated so that the separate steps in a percentage bid will be well defined. This will result in less confusion for city officials employing engineers.

An illustration of the benefits of closer relations with local societies was afforded by the efforts of the Waterloo Technical Society, which coöperated with the society in publicity work looking toward getting a record attendance, and in arranging local details of entertainment and trips. The attendance, 140, surpassed former records.

Prof. J. H. Dunlap, Iowa State University, spent three months last summer inspecting 39 of the 100 sewage treatment plants of the state for the State Board of Health. His paper on the subject indicated, with few exceptions, shameful neglect in operation. The four remedies suggested were proper design, a requirement by the State Board of Health of operation for one year by the engineer, authorization

of central control by the board and increased financial support for the board to make this effective.

Of unusual value was a paper by a contractor, Stanley D. Moore, on "Estimating Construction and Overhead Costs of Sanitary Sewer Systems." In it were given segregated costs of overhead from Mr. Moore's experience for five years on $500,000 worth of work, previous to 1917, and his estimates for 1918, which will have to be increased from 18.4% to 24% of the gross cost or 31.7% of the net cost. Less secrecy on the part of the contractor and more consideration on the part of the engineer, giving added service to the client, must come, in his opinion.

D. P. Dale outlined various engineering methods used in the construction of the drainage districts at the 4½-hour session of the drainage section carried on simultaneously with that of the highway section, where a war program for county highway construction was the main topic, presented by A. F. Fischer and John L. Parsons.

The newly elected officers are as follows: President, C. H. Young; vice president, Nathan B. Barber; directors, C. H. Currie and H. H. Dean. J. H. Dunlap, Iowa City, is the secretary. John T. Drug is chairman of the drainage section, H. H. Dean of the highway section and F. S. Alden of the municipal section.

Pittsburgh Uses New System To Revise Building Code

Pittsburgh is revising its building code by a new method. A salaried engineer-secretary has been appointed. He arranges one section of the new ordinance at a time, first calling upon representatives of the various building material interests to present recommendations. The first draft of each section is presented to the building code commission, consisting of an architect, an engineer, a builder, an insurance man and an attorney-at-law. When the code is formulated, it is discussed by the Pittsburgh chapter of the Institute of Architects, the Society of Engineers, Builders' Exchange, Insurance Exchange and other interested organizations. After thorough discussion the proposed code is put before the city government for action.

Union College Puts Up Inspiration Bulletin Boards

Prof. A. B. McDaniel, head of the civil engineering department of Union College, Schenectady, N. Y., has recently put into operation a plan whereby the achievements of Union's engineering alumni will be exhibited at stated periods upon one of the college bulletin boards. The interest of graduates in the work of the engineering students will be indirectly increased thereby, it is believed. The display of brief sketches of post college careers and of pictures of noteworthy pieces of work is expected to furnish a strong incentive to better work by students.

January Water-Works Troubles

Difficulty With Frozen Pipes and High Consumption Told at Meeting of Water-Works Association

Experiences with frozen pipes and excessive water consumption and waste during the abnormally cold weather of January and February were told after the luncheon of the New York section of the American Water-Works Association in New York City Feb. 20. At the same meeting Edward S. Cole was elected as governor or chairman of the section to succeed Allen Hazen.

Judging from the experiences related, every water-works in the metropolitan district suffered much from frozen services and many from frozen meters, mains and fire hydrants. The most common method of thawing services and mains was by the use of electric current. As a rule, the local electric companies were relied on to do the thawing. They charged from $15 to $30 per 50-ft. service, $20 being the most common sum reported. It appears that the bill for thawing is generally paid by the water consumer.

The successful use of three storage batteries mounted on a truck instead of current from transmission lines was reported in a letter from F. A. McInness, Boston. With about 280 amperes at 38 volts the time for thawing a service by this outfit, after making ready, was 3 to 5 minutes. A. W. Cuddeback, Paterson, had just begun using a similar outfit. John M. Diven, Troy, N. Y., thought this plan was better than depending on an electric company and having high tension wires around.

Electric and Steam Thawing

Several members told of using truck-mounted gasoline motors to drive electric generators for pipe thawing, or of rigging up Ford or other cars for the purpose instead of buying current.

Steam thawing was reported by several. The consensus of opinion was that refreezing was less likely after steam than after electric thawing, because the steam does a more thorough job of ice removal, and of warming up the ground around the pipe. Thawing by means of hot water forced in through tubing was reported by several as having given good results.

How meters help in zero weather was illustrated by Mr. Cuddeback, Montclair, N. J. With 100% of services metered, the February consumption in Montclair is always below the average for the year, while in Paterson, which is 65% metered, the February consumption runs highest year after year. This contrast was greater than usual during the excessively cold weather of February, 1918.

The experience meeting brought out such a variation in methods and costs of thawing frozen pipes as to lead to the suggestion that something ought to be done in the way of standardization. It was also thought desirable to obtain more extensive data on the effect of the 1918 abnormal cold spell on water-works operation. A resolution was passed directing the incoming chairman of the section to appoint a committee to gather data on the subject with the understanding that Secretary Diven would institute a similar canvass by the other sections of the association and try to have the results of the various investigations submitted at the convention of the American Water-Works Association at St. Louis, May 13 to 18.

Sewerage Survey Bonds Voted

The city council of Akron, Ohio, has voted a bond issue of $50,000 to make a survey of its existing sewerage system and comprehensive plans for proposed improvements. It is expected that the bonds will be sold and the work begun by Apr. 1. The work will be conducted under H. S. Morse, director of public service, and will be in charge of E. A. Zeisloft, city engineer.

Engineering Societies

Calendar

Annual Meetings

AMERICAN RAILWAY ENGINEERING ASSOCIATION; 910 Michigan Ave., Chicago; Mar. 19-21, Chicago.

AMERICAN WATER-WORKS ASSOCIATION; 47 State St., Troy, N. Y.; May 13-18, St. Louis, Mo.

The 1918 convention of **The American Water-Works Association** will be held at the Planters Hotel, St. Louis, Mo., May 13 to 18, and not May 20-25, at St. Paul, as stated in last week's issue of *Engineering News-Record*.

At a meeting of a large number of engineers of North Carolina held in Durham Feb. 18, plans were perfected for the permanent organization of **The North Carolina Society of Civil Engineers.** It was decided to hold a meeting of the executive committee in Raleigh, N. C., early in March, to draw up a constitution and by-laws and plan of organization to be submitted at the next meeting of the society. The following officers were elected: John H. Ambler, Winston-Salem, N. C., president; R. P. Coble, Greensboro, N. C., vice president; and Ira B. Mullis, Raleigh, N. C., secretary-treasurer.

The Connecticut Society of Civil Engineers, one of the oldest of the local technical associations in the country, held its 34th annual meeting at Hartford, Conn., Feb. 19 and 20. Its regular program, a day and a half, devoted to a technical session, with an intermediate banquet, was followed, and in spite of war conditions and the absence of a great number of members in war service, all meetings and the banquet were well attended. William R. Dunham, Jr., chief engineer of the Connecticut Co., New Haven, was elected president for the ensuing year. J.

Frederick Jackson, of New Haven, is secretary of the society.

The Southwestern Water-Works Assn. will hold its annual convention Apr. 23-26 at Tulsa, Okla.

At the meeting Feb. 27 of **The Municipal Engineers of the City of New York**, a paper entitled "Influence of City Zoning on Sewage Flow Assumptions, Using Floor Area Basis," was presented by Walter S. McGrane, assistant engineer, Bureau of Sewers, Borough President's Office, Manhattan. The paper was illustrated by lantern slides.

An organization to be known hereafter as **The Engineers' Club of Quincy**, Ill., was formed at a meeting held Feb. 6. C. A. Wiener was elected president and E. F. Charsha, secretary, *pro tem.*

At the meeting of **The Albany, N. Y., Society of Civil Engineers**, Feb. 26, William G. Davison, of the Central Y. M. C. A., delivered an address on "Activities at Camp Wadsworth," with special reference to building and labor problems. Mr. Davison lived, while at camp, with the engineering troops.

The Oregon Society of Engineers, in annual session at Portland, Feb. 4, elected officers for the ensuing year as follows: Orrin E. Stanley, president, formerly secretary of the association; C. J. Hogue, secretary.

The next meeting of **The Harvard Engineering Society of New York** will be held at the Harvard Club, New York City, Mar. 8. Major W. A. Starrett, chairman of the Committee on Emergency Construction of the War Industries Board, Council of National Defense, will speak on "Cantonment Construction," illustrating his talk with motion pictures and lantern slides. The members of the Yale, Princeton and Cornell societies have been invited to attend the meeting.

On Mar. 1 **The Detroit Engineering Society** will listen to the reading of a paper by George F. Porter, on "The Raising of the Quebec Bridge." Mr. Porter was the engineer of construction for the St. Lawrence Bridge Co., Ltd., and had charge of all operations in connection with the building of the bridge. The lecture will be illustrated.

The Kootenay Branch of the Engineering and Technical Institute of British Columbia, with headquarters at Nelson, B. C., was formed recently. The institute, which will apply to the Legislature at the forthcoming session for a charter, will be an organization composed of civil and mining engineers, architects and members of allied professions. W. M. Cunliffe is provisional chairman; A. E. Pickford, provisional secretary-treasurer.

The New Jersey Sewage Works Association has elected the following officers for the ensuing year: President, Paul Molitor, Madison; secretary, Fred T. Parker, Atlantic City. George F. Fuller, consulting engineer, New York, read before the association a paper on the operation of sewage work plants.

At the annual meeting of **The Canadian Society of Civil Engineers** the proposed bylaws of the Montreal branch were received and at the first meeting of the council thereafter, Jan. 28, the new bylaws were adopted. These provided for the formation of the Montreal branch of the society and as a petition signed by a sufficient number of corporate members of the society was presented, the council indorsed the establishment of the Montreal branch. On Feb. 14 the branch was formally established. Nominations will be received on Feb. 28 and a ballot opened on Mar. 14.

At the luncheon and meeting of the **Chattanooga, Tenn., Engineers' Club**, Feb. 21, O. A. Dietz spoke on the manufacture of sewer pipe.

PERSONAL NOTES

MAJ. H. W. DURHAM, Engineers' Reserve Corps, has been placed in command of the 41st Engineers, the first of the new road battalions to be organized for road construction and maintenance, in connection with the work of our expeditionary forces abroad.

BERNT BERGER, consulting engineer, has removed his office to 150 Nassau St., New York City.

J. P. NELSON, in addition to his duties as valuation engineer, Chesapeake & Ohio Railway Co., has been appointed real estate agent at Richmond, Virginia.

CAPT. ROBERT CUTTING, 20th Engineers, U. S. Reserves, is in a base hospital in France, recovering from spinal meningitis.

C. C. COTTRELL has been appointed state highway engineer of Nevada, vice R. K. West, resigned. Mr. Cottrell has been assistant state highway engineer since the organization of the State Department of Highways. Before that time he was with the California Highway Commission for four years.

ROBERT H. WHITTEN, after several years of city planning work with the Heights of Buildings Commission and as secretary of the Commission on Building Districts and Restrictions and the Committee on the City Plan of the Board of Estimate and Apportionment of New York, has opened an office, for consulting work on city planning and zoning, at 277 Broadway, New York.

MISS HELEN JORDAN, assistant bacteriologist in the laboratory of the Minnesota State Board of Health, has been selected to take charge of the city health laboratory of Norfolk, Va., succeeding Henry G. Parker, who resigned to enter the Army Medical Corps. Miss Jordan took special work in public health at the Massachusetts Institute of Technology last year.

H. A. RANDS, civil engineer of Portland, Ore., through an appointment recently made by the Port of Portland Commission, is to have charge of the traffic survey of the Upper Columbia and Snake Rivers. Mr. Rands will submit his suggestions and reports on the work to the Port of Portland's traffic survey committee. The survey is a preliminary move toward increasing Portland's water transportation, with a view to inaugurating a steamer line from Portland to the upper rivers. The sum of $5000 has been set aside for defraying the expenses of the undertaking, which is expected to be completed in from three to six months.

P. J. FARRELL, solicitor of the Division of Valuation, Interstate Commerce Commission, has been appointed chief counsel of the commission, succeeding Joseph W. Folk, resigned.

FRANK H. CENFIELD, acting head of the efficiency staff of the Chicago city council finance committee, has received a commission as captain in the Quartermaster's Department.

J. S. LANGTHORN has become connected as consulting engineer with the Beaver Engineering and Contracting Co., of 51 Chambers St., New York City. Mr. Langthorn received his education at the School of Mines, Columbia University, taking the mining course. He was with the Department of Bridges, New York City, for eight years, as engineer in charge of the Boroughs of Brooklyn and Richmond. He was senior division engineer with the Board of Water Supply of New York for ten years, five years on the Ashokan Dam and five years on the city aqueduct tunnels, pipe lines and Silver Lake reservoir. For the past two years he was Deputy Commissioner of Water Supply for Brooklyn. He is an ex-president of the Brooklyn Engineers' Club and secretary of the military engineering committee, which recruited the Eleventh Engineers.

MAJ. FREDERICK HUMPHRIES, of the 102nd Engineers, at Spartanburg, S. C., has been transferred in his present rank to the aviation section of the Signal Corps.

WILLIS T. BURNS, Butte, was elected president of the Montana Society of Engineers at the annual meeting held in Butte, Feb. 11.

W. O. MCCLUSKY, county engineer of Ohio County, West Virginia, in which Wheeling is situated, has been appointed to represent the state road commission in Marshall County.

WILLIAM G. THOMPSON has been appointed by the New Jersey State Highway Commission as state highway engineer for a term of five years at a salary of $7000 per annum. He will succeed Robert A. Meeker, whose term expires on Apr. 1. Mr. Thompson was formerly associated with

Major General Goethals as engineer of construction on the Panama Canal. Edward E. Reed, of Trenton, was appointed assistant engineer for five years at a salary of $5000.

S. E. HUTTON, for several years head of the mechanical and electrical engineering departments of the University of Idaho, and since 1914 consulting engineer of the Idaho State Public Utility Commission, recently enlisted as a private in the aviation section of the signal corps. Mr. Hutton was formerly a member of the faculty of Highland Park College at Des Moines, Iowa, and of the University of Kansas.

C. E. HICKOK, city engineer of Alameda, Calif., has been commissioned a captain in the Engineer Reserve Corps.

CHARLES D. WEIRBACH, city engineer of Allentown, Penn., has resigned to accept a position with the United States Government as sanitary engineer under the Director of Health and Sanitation, U. S. Shipping Board, Emergency Fleet Corporation. He will serve as sanitary engineer of the Hog Island shipyard, Philadelphia; the shipyard at Bristol, Penn., and the plant of the Submarine Boat Corporation at Newark, N. J., with headquarters in Philadelphia.

HANS MUMM, JR., city engineer of Everett, Wash., recently resigned his position to accept one with the Portland Cement Assn. He has been assigned to work in eastern Washington and Idaho, with headquarters in Spokane. Mr. Mumm has lived in Everett since 1902, when he was employed in the engineering department of the Great Northern Railway Co. Since 1902 he has been assistant city engineer, county engineer and city engineer, and has also been connected with private concerns.

MAX W. KING, formerly with the James Stewart Co., Inc., Watervliet, N. Y., is now with the Central Construction Corporation, Magnolia, Md.

PROF. ROY A. SEATON, of the division of engineering, department of applied mechanics and machine design, Kansas State Agricultural College, is now a captain in the Ordnance Reserve Corps, and is stationed in Washington in the artillery ammunition section engineering bureau of the ordnance department.

H. H. TRIPP, who has been resident engineer of the Canadian Pacific Ry. at Kenora, Ont., is now with the Edmonton division, at Edmonton, Alta. He succeeded R. C. Harris, who has gone to the Calgary division.

L. B. ALLEN, recently appointed superintendent of maintenance-of-way of the Chesapeake & Ohio system, with headquarters at Huntington, W. Va., began his railroad work as a rodman with the Southern Ry., after his graduation from Kentucky State College in 1899. After advancing through various grades in the service of the Chesapeake & Ohio, he became superintendent of the Huntington and Big Sandy divisions in February, 1914. At the time of his most recent promotion he was general superintendent of the western general division.

EDWARD G. LEE has left the employ of Walter H. Sawyer, Lewiston, Me., and is now connected with the engineering department of the Southern Power Co. at Charlotte, North Carolina.

C. R. EGE, who was until recently division engineer, American Association of Portland Cement Manufacturers, at Seattle, Wash., is now connected with the Portland Cement Association, Chicago.

F. S. PARRIGIN, formerly of Fort Lauderdale, Fla., is now supervising engineer of Bay County, Florida, road and bridge construction for E. V. Camp, consulting engineer, Atlanta, Georgia.

E. G. SHEIBLEY, civil and sanitary engineer, Riverside, Calif., has recently been appointed assistant sanitary engineer in the United States Public Health Service, and has been ordered to report for duty at Little Rock, Ark., in the sanitation of extra-cantonment zones. Mr. Sheibley received his technical training at Leland Stanford Jr. University, graduating from that institution in 1908, and in 1914 was granted the degree of M.C.E. by Harvard University on the completion of a year of post-graduate study.

HAROLD G. MCGEE, assistant engineer and chemist in the office of the sanitary engineer, Lucas County, Ohio, has been commissioned first lieutenant in the Sanitary Corps of the National Army and will report for duty at Camp Greenleaf, Fort Oglethorpe, Georgia.

I. F. LAUCKS, formerly of Falkenburg & Laucks, Seattle, Wash., has opened chemical assay and metallurgical laboratories at 99 Marion St., Seattle.

JAMES E. BARLOW, who has held the position of Public Service Director since Dayton, Ohio, adopted the commission-manager form of government, was chosen City Manager, succeeding Lieut. Col. Henry M. Waite, at a salary of $7500 per year. Mr. Barlow was graduated from the Massachusetts Institute of Technology in 1905. For a few years he was assistant engineer in the designing department of the Board of Water Supply, New York. He became connected with the Bureau of Municipal Research, and prior to his connection with the city engineering department of Cincinnati he was employed there on work for the bureau.

J. P. NEWELL, of the engineering firm of Newell, Cossett & Walsh, Portland, Ore., has accepted a position with the Canadian Northern Railway Co. as valuation expert. Until he entered private practice in Portland about ten years ago, Mr. Newell was employed by the engineering department of the Oregon-Washington Railroad & Navigation Co. More recently he has been engaged in railway valuation work for the Oregon Public Service Commission.

C. L. HINKLE, general superintendent of the Toledo, St. Louis & Kansas City Ry., has been appointed to a position in the railway engineering forces of the U. S. Army in France with the rank of major.

B. G. MCBRIDE, formerly assistant state engineer of Nevada, has been commissioned as captain in the ordnance department of the army and is now on duty at Washington.

JOHN B. EMERSON is now contracting manager of the La Salle Engineering Co., Chicago. For about ten years he has been in charge of work in the southwest for Robert W. Hunt & Co., Chicago. The La Salle Engineering Co. has taken on a considerable amount of work in marine engineering and steel ship design, and has therefore moved its general offices to larger quarters in the Old Colony Building. A. B. Boyer is general manager and I. A. Baum is assistant general manager of the company.

MAJ. THOMAS F. MCGILVRAY, formerly of the Duluth Engineering Co., and for a number of years city engineer of Duluth, Minn., is in active training with the United States Engineers at Camp Lee, Petersburg, Va. He was commissioned a major of engineers last April.

OBITUARY

A. H. BAYFIELD, engineer in charge of the Canadian Government's assembling plant for munitions at Ogden Point, B. C., died Feb. 13. He was formerly superintendent of dredges for British Columbia under the Canadian government, and had previously been engaged extensively in wharf construction at St. John, N. B., and other eastern ports.

JUSTIS W. BROCKETT, 70 years old, civil engineer, who was active in movements for the improvement of the Missouri River, died at his home in St. Joseph, Mo., Feb. 8. He directed the work a decade ago whereby many acres of land on the river front at St. Joseph were reclaimed for use of the railroads, and promoted several railroad projects.

JOHN A. LIGHTHALL, 85 years old, died Feb. 16 at Syracuse, N. Y. He was the grandfather of the late Capt. Philip K. Lighthall, who was a victim of the Tuscania, Feb. 5. John A. Lighthall was born in Albany. He was a civil engineer during his younger days, and went to Syracuse in order to take charge of the construction of the second line of the New York Central between Syracuse and Rochester. In 1858 he removed to Chicago, where he became a manufacturer. He returned to Syracuse in 1875.

INDUSTRIAL NEWS AND COMMENT

ABOUT MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Eastern Equipment Dealers Foresee Good Year

Government Work, Industrial Expansion and Highways Expected to Reach Substantial Total

Contractors' equipment dealers in the East throw some interesting sidelights on the construction outlook this spring. These men live close to the contractor. They must anticipate his needs. They must not overstock, for storage warehouse capacity is at a premium now.

As viewed by the construction equipment men, the volume of work this year will be as large or larger than in 1917. It will not be along the usual lines. Government work and construction for the war industries are expected to predominate. Highway work, as much as may be sanctioned by the Federal Government, will gravitate toward those best equipped to handle it. In other words, they foresee the entrance of the larger construction organization into highway work.

Are the big construction equipment dealers backing up their words with action? It appears so.

In spite of heavy government demands during January and February, and in the face of severe shipping difficulties, they have maintained stocks of equipment sufficient to meet the demands of a construction year fully up to normal.

New Warehouse Established

Some of the conversations with equipment men are interesting in their bearing upon the general construction outlook.

"Our companies foresaw the demand for construction equipment and put in large stocks of steel plate and other raw materials," said Burr R. Brown, of the Brown & Sites Co., 30 Church St., New York. This company represents the Lakewood Engineering Co., Clyde Iron Works, Lawrence Machine Co., and the Nye Steam Pump and Machinery Company.

"Several months ago our companies established a warehouse in Philadelphia with a stock of all equipment," continued Mr. Brown. "Philadelphia was selected because of the freight congestion at New York. Good second-hand equipment on the market is being rapidly used up. At the plants we find that shipments are becoming more and more prompt, showing that they are clearing themselves.

"In addition to the war factory work I look for a revival of railroad construction, principally extra tracking and terminals.

"I believe that road contracts will be let in sufficiently large blocks this year to attract the big contractors into this class of work. A man who has 30 miles of road construction can afford to put in proper plant to handle it. In fact, the only economical way to handle road work this year is to attract this class of big contractors."

That war construction and factory expansion will make a busy season for the building contractor and general contractor is the view of R. E. Brooks, who represents the Koehring Mixer Co., the C. H. & E. Mfg. Co. and Insley Mfg. Co., in New York City.

"The amount of construction work which the government contemplates, along with the industrial work already planned," said Mr. Brooks, "will make this year one of the busiest that we have known. There likely will be some extension of the railroads. Paving work must go ahead. At this time, when the railroads have proved inadequate, the building of good roads to supplement the rail lines is important. Only big contractors will enter highway work this year. The bonding companies will bond only big construction companies, and only these contractors will have the nucleus of an organization to handle the work. Regarding labor—the contractors who are willing to pay the price will be able to get enough common labor to carry on a reasonable amount of work."

An interesting development in the revolving steam shovel field has been the increased use of this equipment for industrial purposes. Some manufacturers are equipping the ¾-yd. revolving shovel as a locomotive crane. The Ball Engine Co. and the Thew Automatic Shovel Co. have helped in this way to meet the unprecedented demand for locomotive cranes.

Broader Steam-Shovel Market

H. A. McLaughlin, Eastern representative of the Thew Automatic Shovel Co., commented as follows upon the shovel situation: "Although we have 50 Thew shovels on Government work on the Atlantic coast there have been few sales to contractors lately. This is accounted for largely by the cessation of other construction activities at this season. However, the industrial uses of the revolving shovel have been broadening fast. High demurrage charges on railroad cars have forced industrial plants to adopt new methods of unloading bulk materials, coal in particular. Thew shovels are being rigged with structural steel booms and ½ yd. or ¾ yd. clamshell buckets for this locomotive crane service. Smaller types of Thew shovels, electrically driven, are being extensively used for loading gypsum and other bulk materials in the interior of industrial plants. This industrial demand has been very active lately."

George C. Dodge, of the Dodge & Anderson Corporation, New York agents for the Oshkosh Line, and the Byers Machine Co. "Autocrane" equipment, expects that the increase of motor freight traffic this year will force road construction. Industrial demand continues active. "The Autocrane has been in demand for unloading coal," said Mr. Dodge. "We have just received an order from the New York State Barge Canal for 14 Autocranes for handling freight at Barge Canal stations. Big paving companies and larger contractors probably will turn to road work this year, and we expect that they will buy equipment in large amounts."

Many Millions in Government Construction Contracts

Here are some Government contracts for building construction which are soon to be let in Washington, D. C., by the War Department:

Housing for employees at Bush Terminal, Brooklyn, N. Y., in connection with an extension of the $20,000,000 extension of the plant. The housing operation will cost $50,000.

Port development at Boston, Mass., including storehouses, tracks, barracks, buildings and general improvements, to cost about $10,000,000.

Port development at Charleston, S. C., including storehouse, barracks and other buildings, tracks and equipment, to cost about $12,000,000.

Other work contemplated includes a high-explosive plant depot at Sandy Hook, N. J., to cost $250,000, and storehouses at Harrisburg and Middletown, Penn., each of which is expected to cost more than $1,000,000.

Northwestern Builders Organize

At a recent meeting held by the Seattle Master Builders' Assn., and the Tacoma Master Builders' Assn. at Tacoma, Wash., it was decided to proceed with the formation of a Northwest Master Builders' Assn. The committee from each association will shortly call a general meeting of building contractors of Oregon, Washington, Idaho and Montana, at which time the Northwest Master Builders' Assn. will be formally launched. E. J. Rounds, of the Rounds Construction Co., Seattle, representing Seattle master builders, and S. Christian Erickson, general contractor, Tacoma, were appointed chairmen of committees to effect the organization.

Southern Pine Association Looks for a Busy Year

Emergency Bureau Outlines War Work Past and Future—Growth of Mill Construction

A review of the war work accomplished by the Southern Pine Emergency Bureau and an outline of this year's war program in the lumber trade were important features of the recent annual meeting of the Southern Pine Association in New Orleans.

In his address on "How the Southern Lumbermen Are Helping Win the War" W. H. Sullivan, chairman of the Emergency Bureau, stated that more than 500,000,000 ft. of lumber had been furnished for cantonments, aviation fields, structures and other Government work.

In order to meet emergency cases in the East, the Government requisitioned large amounts of timber and lumber in several of the large Eastern yards. The Southern Pine Emergency Bureau is being called upon to replace such of these stocks as the Government may specify, at regular Government prices.

With regard to the outlook for this year Mr. Sullivan mentioned additional cantonments, warehouses, hospitals and other Government buildings which are expected to total $290,000,000 worth of construction, largely of timber. The industrial housing program will require a great amount of lumber.

Up to Feb. 12 ship timbers amounting to 13,781 carloads, or 220,000,000 ft., had been furnished to the Emergency Fleet Corporation on orders of the Bureau. In order to have plenty of material in the more unusual sizes available, the Bureau placed orders for 50,000,000 ft. of these sizes, a large portion of which is now en route.

Mr. Sullivan described a new type of timber ship which was launched last week by the National Shipbuilding Co. of Texas, which is building two of the vessels for the Cunard Line. The ship has a steel keelson, the rest of the construction being timber. Contracts have been placed by the Emergency Fleet Corporation for twelve of these vessels. It is expected that one hull will be launched every eight weeks.

In the report of the grading committee of the Southern Pine Association special mention was made of the success of the "density rule" in creating a demand for structural timbers. The rule is said to be exerting a strong influence in the return to favor of mill construction, due to the greater accuracy which it effects in determining the strength of timbers.

Other papers and reports of interest were presented at the meeting.

Water-Works Manufacturers Prepare for Convention

At a session of the executive committee of the Waterworks Manufacturers' Association Feb. 20 arrangements were made for the annual convention of the American Water-Works Association which will be held May 13 to 18 at the Planters Hotel, St. Louis. The following committees were appointed: Executive: E. B. Hodgman, chairman; George R. Ellis, H. F. Brown; entertainment committee: D. O'Brien, chairman; F. B. Leopold; W. C. Sherwood, Fred. Mueller, I. S. Holbrook, W. Van Winkle, Jr.; printing committee: I. S. Holbrook, chairman; D. B. McCarthy; badge committee: J. A. Kienle, chairman; E. K. Sorenson; transportation committee: W. H. Van Winkle, chairman; Fred. J. Bradley, T. C. Clifford, H. M. Lofton, L. S. Barnard.

Capital and Labor Join Hands To Make War Program

Government Calls Conference in Washington to Adjust Differences Concerning Nation's Industries

More than 70,000 manufacturing plants and more than 2,000,000 industrial workers are represented at the conferences being held at Washington at the call of the Government. The purpose is the promotion of smooth running of industry during the war. The first session was held Feb. 25, and the meetings will continue for several weeks.

An effort will be made to arrive at a definite understanding regarding methods of determining wages, piecework rates, and prices, elimination of restrictions on output, control of the dilution of labor, discrimination against union or non-union labor and the admission of union agents to plants.

The conferees were named by the National Industrial Conference Board, representing employers, and the American Federation of Labor.

The representatives of employers are Loyall A. Osborne, New York, Vice President of the Westinghouse Electric and Manufacturing Co., W. G. Van Dervoort, East Moline, Ill., President of the Root & Van Dervoort Engineering Co.; L. F. Loree, New York, President of the Delaware & Hudson R.R., and C. Edwin Michael, Roanoke, Va., President of the Virginia Bridge and Iron Co.; B. L. Warden, vice-president of the Submarine Boat Corporation.

The representatives of the workers are Frank J. Hayes, Indianapolis, President of the United Mine Workers; William L. Hutcheson, Indianapolis, President of the Brotherhood of Carpenters; Victor Olander, Chicago, representative of the Seamen's Union, and T. A. Rickert, Chicago, President of the United Garment Workers. One more representative of labor is still to be selected, as J. A. Franklin, president of the Brotherhood of Boilermakers, was unable to attend.

Builders Aid the Government

The Master Builders' Exchange of Philadelphia is gathering data for the use of the United States Government regarding building-material supplies in Philadelphia and its vicinity.

A Real Snow-Plow Needed for Highway Work

Recent Blizzards Indicate Opportunity for Manufacturers and Highway Engineers to Coöperate in Design

In bucking the snows that blocked highway traffic from the Rockies to the Atlantic during the six weeks just past, state highway officials turned to every conceivable makeshift. The full story of this fight against blizzard conditions is told in this issue of *Engineering News-Record*.

State and county officials are interested in the development of a real highway snow-plow. Probably an adaptation of the railroad type of "rotary" would be most practicable, as it throws the snow clear of the road.

The time for undertaking the work is now, while the lessons of the late storms are fresh in mind. The market may be limited, but the development of a highway snow-plow should be regarded in the light of a patriotic service.

Coöperation between engineers on state and county highway work and the companies manufacturing snow-plows, motor trucks and tractors will undoubtedly result in the production of a real highway snow-plow.

Notes of the Industries

C. W. Hunt Co., Inc., of West New Brighton, Staten Island, N. Y., manufacturers of conveying equipment, announce the removal of their New York City offices from 45 Broadway to the Astor Trust Building, 501 Fifth Ave., at the corner of 42nd St. The U. S. Government has taken over for its own use the entire building at 45 Broadway.

The National Lime Manufacturers' Assn. has sent a query to its members regarding the location of its postponed annual meeting. Chicago, Pittsburgh and New York are being considered.

The Empire Steel Co., which was chartered recently in North Carolina, plans to specialize on seamless steel pipe. Offices are in Raleigh, but the plant site has not been acquired. According to a statement given out by the company, plans are made for a steel plant of 100,000-ton capacity, a blooming mill, a bar mill and tube mill, with offices, laboratories and a 10,000-hp. electric plant.

The Westinghouse Electric and Manufacturing Co. announces the removal of its Arizona office from Phoenix to Tucson. Its representatives, J. H. Knost and W. G. Willson, will have headquarters in the Immigration Building at Tucson.

W. H. Thompson, for many years prominent in the heavy electric traction work of the Westinghouse Electric and Manufacturing Co., has resigned to become works manager of the Fairmont Mining Machinery Co., of Fairmont, W. Va., makers of coal-mining equipment.